BOSTON
MASSACHUSETTS

TRAFFIC CIRCULATION AND PARKING PLAN

CENTRAL BUSINESS DISTRICT URBAN RENEWAL AREA

PREPARED FOR THE BOSTON REDEVELOPMENT AUTHORITY BY BARTON-ASCHMAN ASSOCIATES

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NOVEMBER, 1967

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INTRODUCTION

DOWNTOWN BOSTON is the single largest generator of travel in New England. Over 1.25 million trips by people in cars, trucks, and mass transportation occur each day within this relatively small and intensely developed area. It lies at the hub of an expanding network of highway and public transportation facilities. The flow of goods and people to and from the business district of Downtown Boston depends upon this regional network. The future will see this relationship become more intense as the Central Business District remains the principal site for commercial development. Deficiencies in this network must inevitably retard the growth and economic health of the area.

The purpose of this study has been to develop a traffic access, circulation, and parking plan consistent with established principles and designed to meet the specific requirements of the Boston Central Business District.

As a part of the circulation planning process, all available information on traffic, parking, and transportation was analyzed. This included cordon count reports prepared by the Boston Traffic Commission; data and reports prepared by Wilbur Smith and Associates dealing with transportation in the Boston area; special transportation reports prepared by Boston College; data from the Massachusetts Bay Transportation Authority, Massachusetts Department of Public Works, and the Metropolitan District Commission; plus background information from the files of the Boston Redevelopment Authority. Various additional studies and analyses were undertaken by other interested agencies during the period that this report and the resultant Central Business District Plan have been in preparation. Whenever possible, new data produced by these studies have been employed to refine the findings of this study.

In addition, special data was collected by Barton-Aschman Associates during 1963-1964 through the following field surveys:

1. Selective traffic volume counts and intersection turning movement studies.

2. Origin-destination studies of motorists at critical and representative locations in the downtown area.

3. Pedestrian counts and interviews to determine walking distances and patterns.

4. Special interviews of employees and patrons at selected locations to establish the mode of transportation used and purpose of trip.

5. Inventory of all on- and off-street parking spaces in the Central Area.

6. Parking occupancy and turnover studies throughout the area.

7. Inventory of truck loading activities in the Central Area, both on-street and off-street.

This study was initiated in January, 1963. Periodically during the three-year course of the work, relevant aspects of the study were published in a series of five memorandum reports submitted by Barton-Aschman Associates and presented at meetings by consultant staff. The reports are:

Principles Governing Downtown Boston Circulation Planning, August 19, 1963.

Inventory of Plans and Projects of Public Transportation Agencies as They Affect Downtown Boston, September 12, 1963.

Establishment of Preliminary Circulation Planning Criteria for Downtown Boston, September 20, 1963.

Analysis of Existing Circulation and Parking in Downtown Boston, June 23, 1964.

Traffic, Parking, and Transportation Analysis Central Business District Area, Boston, Massachusetts, September, 1965.

During the course of this study various actions which affect existing travel patterns were taken. Some of these are completion of the Massachusetts Turnpike Extension, major progress in Government Center, completion of buildings such as the State Street Bank, significant development at Prudential Center, and initiation of transit improvements. All of these actions were anticipated and taken into account. Similarly, early land acquisition activities now underway in the Central Business District were considered in developing the recommended plan.

Throughout the conduct of this study several *study areas* were employed. There were various reasons for this: The immediate objective of a particular segment of the study dictated the nature and extent of the area included. Other studies and analyses were undertaken by interested agencies and an effort was made to facilitate comparison of data by making the areas coincidental. Portions of a preselected study area were

deleted or the entire area was expanded by general concensus of the planning bodies.

As this report is concerned specifically with the Boston Central Business District, every effort has been made to relate collected data to this area alone. Where it has not been reasonable to do this, the particular study area to which the data applies has been carefully delineated. Thus, three study areas are referred to in the text and identified in Figure 1:

1. *Central Business District,* referred to as the *CBD.* The Central Business District is defined by the Boston Redevelopment Authority as Urban Renewal Area R-82 and *includes* the South Station Area.

2. *Downtown Central Area,* referred to as the *DCA.* This area was selected by the consultant as the appropriate study area for some of the earlier memorandum reports and consequently much of the field data relates specifically to the *DCA.* The *DCA* is approximately equivalent to the *CBD,* as shown in Figure 1. Except for situations where it is necessary to distinguish between the two, the Central Business District (CBD) and the Downtown Central Area (DCA) are considered as analogous, both being regarded as the CBD.

3. *Downtown Boston,* or *Boston Proper,* is the entire peninsula north and east of Massachusetts Avenue.


STUDY AREAS
N
0
1000
2000
SCALE IN FEET
DELINEATION OF STUDY AREAS
DOWNTOWN BOSTON
DOWNTOWN CENTRAL AREA
CBD PROJECT AREA INCLUDING SOUTH STATION AREA

FIGURE 1

1
ANALYSIS OF EXISTING CONDITIONS

THE STREET, parking, and transit system of the Boston Central Business District is antiquated. Major elements were built piecemeal in the earliest years of the city and were never calculated to accommodate the traffic and transportation needs of the present day. With respect to the key principles of adequate capacity, understandable circulation pattern, sufficient parking facilities, and good public transportation, the system is seriously deficient throughout the entire Central Business District Project Area.

PHYSICAL CHARACTERISTICS OF THE STREET SYSTEM

The capacity required of any street depends on the traffic volumes it must carry. However, even with the lightest volumes and under the most favorable operating conditions, there are minimum capacities that might be considered acceptable. In a dense commercial section such as the central area a *minimum* dimension is considered to be 33 feet, curb to curb. This allows for one lane to be blocked by an occasional stopped vehicle and still provide two lanes for traffic to proceed with reasonable efficiency. The few streets throughout the central area, such as Tremont, Congress, Boylston, Stuart, and Kneeland, which might otherwise approach modern standards are overloaded due to the deficiencies of the remaining elements of the street system.

The streets in the Central Business District that currently are a part of the basic circulation system, yet lack minimum width, as shown by curb-to-curb dimensions, are listed in Table 1.

Other streets in the CBD are not part of the basic circulation system but serve as connectors from one street to another and as service streets for adjoining properties. Although they generally carry light traffic volumes, the minimum dimension of 33 feet also should apply to these facilities. Streets in the CBD which fail to meet this requirement are listed in Table 2.

In addition to the circulation and connecting streets, numerous minor streets form very short connections or serve as dead-end access to adjoining property. Some of these are extremely narrow and can accommodate only

Table 1
BASIC CIRCULATION STREETS BELOW MINIMUM ACCEPTABLE WIDTH

Street	At	Width[1] (Feet)
Arch	Franklin	26
Bedford	Chauncy	21
Bromfield	Tremont	22
Court	Washington	25
Devonshire	Water	29
Essex	Atlantic	29
Franklin	Hawley	32
Harrison	Kneeland	32
Kingston	Bedford	26
Milk	Washington	32
Otis	Summer	31
School	Washington	21
State	Washington	22
Washington	Milk	28
Water	Washington	21
West	Tremont	22
Winter	Tremont	20

[1]This minimum width exists at one or more critical points along the length of the street.

Table 2
SERVICE STREETS BELOW MINIMUM ACCEPTABLE WIDTH

Street	At	Width (Feet)
Avery	Tremont	26
Carver	Boylston	20
Columbia	Essex	20
East	Atlantic	27
Edinboro	Essex	18
Hawley	Franklin	27
Hudson	Kneeland	24
LaGrange	Tremont	18
Temple Place	Tremont	28
Tyler	Kneeland	24

one vehicle. If the street dead-ends, the narrow width may prevent a turning movement, and it may be necessary for vehicles to back out into the intersecting street. These conditions contribute to the serious capacity deficiency by interfering with normal traffic flow on the intersecting streets.

In addition to specific dimension, continuity of width is another vital factor affecting street capacity. All of the widths quoted previously are typical dimensions of the described streets at specific points. In fact, many of these widths vary from block to block and even within the blocks. As a basic principle of traffic flow, adequate width in one section leading to another section of insufficient width is often worse than insufficient width throughout the street. However, none of the streets listed, with the exception of Franklin Street near Arch Street, ever achieve the minimum acceptable width of 33 feet. The existing variations in width cause variations in capacity and prevent a uniform flow of traffic throughout the street length. An example of a street with this type of variation is shown in Table 3, which lists the width of Devonshire Street at various points along its length.

It must be recognized that the acceptable variation in lane widths on operating streets falls within rigid limits. A difference of only one or two feet, when dimensions are minimum, can have the effect of virtually eliminating the entire capacity of a lane.

Problems of capacity and variations in width are compounded in the CBD by problems of discontinuity and changes of direction. For a street system to be comprehensible to the average driver, sufficient continuity in a large number of the streets is required to offer a clear and easily remembered pattern. If a street has continuity and adequate width to function as a two-way facility, it provides clarity in and of itself. If it is to be operated one-way, the companion street for movement in the opposite direction must be close enough and sufficiently similar in alignment to indicate its function as part of a one-way pair. Such facilities in the CBD street system generally lack both proximity and similarity of alignment.

Table 3
TYPICAL STREET WIDTH VARIATIONS

Street	At	Width (Feet)
Devonshire	Summer	29
Devonshire	Franklin	32
Devonshire	Milk (S)	25
Devonshire	Milk (N)	29
Devonshire	State	32

In the north-south direction, the only continuous streets are Tremont, Washington, and Congress. While portions of Washington Street are wider, Congress is the only one with sufficient consistent width for two-way operation. However, the direction of Congress Street changes from north-south to virtually east-west at its southern extremity. Tremont and Washington form a reasonably effective one-way pair in terms of clarity, but the capacity of Washington Street varies so much that it is not consistent with that of Tremont and no other street is available to pair with Tremont. In the east-west direction, the only really continuous streets are State Street and Stuart-Kneeland. Of these, only Stuart-Kneeland is wide enough for minimum two-way operation and it cannot handle the inbound volumes at present. Although State Street is continuous, it is a one-way (westbound) facility and no other *continuous* street is close enough to provide for traffic movement in the opposite (eastbound) direction.

Four other east-west streets (Franklin-Bromfield, Bedford-West, Boylston-Essex, and School-Milk or Water) are almost continuous, but each has at least one major offset in alignment. Offsets in alignment destroy both clarity and capacity. An offset requires some travel on the intersecting street, whether it is only a few feet or as much as 50 feet. This increases the demand on the intersecting street, requires turning maneuvers through the intersection, and otherwise confuses and congests traffic. There are a substantial number of such offsets in the CBD street system (see Table 4).

Another measure of the lack of continuity in a street system is the number of "T" intersections which occur. A "T" intersection is formed when one street, usually minor, enters another more important street but does not cross it. The "T" intersections are not necessarily undesirable in themselves. They are often useful if the minor street performs a service and does not carry major volumes. However, in many cases, the street is not really minor, such as School at Washington (which has also been

Table 4
OFFSET INTERSECTIONS

Street	Street	At
Beach	LaGrange	Washington
Hayward Place	Avery	Washington
Boylston	Essex	Washington
Franklin	Bromfield	Washington
Kingston	Otis	Summer
Chauncy	Arch	Summer
Water	Water	Congress
Tyler	Oxford	Beach
Tufts	East	South
School	Water or Milk	Washington

described as offset to Water or Milk) or Park at Tremont, but represents a true discontinuity in the major street pattern. Large numbers of "T" intersections indicate severe discontinuities in the street system. Those that involve two streets which are part of the basic circulation system create the most serious problems in the CBD. (See Table 5.)

Another factor affecting both capacity and clarity is the multi-leg intersection--a point at which more than two streets intersect. This type of intersection requires multiple phasing of signal controls, special treatment for protection of pedestrians and vehicles, and generally interferes with the smooth flow of traffic. The CBD contains a substantial number of such intersections as listed below.

Park Square
Essex-Surface Artery
Harrison-Chauncy-Essex
Church Green
Dewey Square
Post Office Square
State-Devonshire-Congress

All of the above deficiencies contribute to traffic movement problems in the central area. Other deficiencies involving various minor streets or alleys contribute to the problem but are not the main source of difficulty.

In considering traffic improvements for the Central Business District, priority must be given to the possibility of eliminating or reducing the

Table 5
"T" INTERSECTIONS

Through Street	"T" Street	Through Street	"T" Street
Tremont	Park	Summer	Devonshire
Tremont	Bromfield	Summer	Hawley
Tremont	Winter	Milk	Hawley
Tremont	Temple Place	Milk	Arch
Tremont	West	Milk	Federal
Tremont	LaGrange	Bromfield	Province
Washington	State (S)	School	Province
Washington	Water	Boylston	Carver
Washington	School	Boylston	Hadassah Way
Washington	Milk	Providence	Hadassah Way
Atlantic	Kneeland	Chauncy	Avon
Atlantic	Beach	Bedford	Columbia
Atlantic	East	Bedford	Harrison
Atlantic	Essex	Essex	Oxford
		Essex	Edinboro

deficiencies by widening those streets in the basic circulation system which are below standard. In some cases closing and replacing them with other streets could be the best solution. Service streets with less than standard width can be widened or, in some cases, entirely eliminated. Frequently, the best solution is to close streets or alleys which are not needed for circulation to eliminate the intersections with other, more important, streets. Offsets in intersections that must be retained should be eliminated wherever possible. "T" intersections should be reduced in number by elimination of some streets and extension of others to provide the continuity needed for the basic circulation pattern.

Throughout those sections of the CBD in which the street capacity and continuity deficiencies are most severe, there also is a serious deficiency of commercial service facilities. The absence of these facilities aggravates the general congestion by requiring that commercial vehicles be loaded and unloaded on the very streets which are deficient in width. Circulation improvements must include some provision for off-street loading.

A general, but very significant, measure of the deficiencies existing in the overall street system is a comparison of existing and anticipated future volumes in terms of available capacity. These volumes are listed in Table 6. Capacities are expressed in terms of existing and required number of moving traffic lanes according to screenline counts.

ANALYSIS OF SPECIFIC VEHICULAR TRAFFIC MOVEMENTS

Traffic volume counts for the morning and afternoon peak hours were analyzed to determine the relative use of the various facilities. These volumes are shown in Figure 2 (A.M. peak hour) and Figure 3 (P.M. peak hour). General observations and qualitative evaluations are as follows:

Table 6
SCREENLINE ANALYSIS AND LANE REQUIREMENTS

Screenline Location	Street Included	Existing Daily Traffic	Future Daily Traffic	Existing Number of Lanes	Required Number of Lanes
So. of State-Court	N-S Streets from Tremont to Atlantic	58,000	90,000	16	22
So. of Summer-Winter	N-S Streets from Tremont to Atlantic	70,000	100,000	17	25
No. of Stuart-Kneeland	N-S Streets from Broadway to Atlantic	64,000	75,000	18	19
E. of Washington	E-W Streets from State to Kneeland	51,000	60,000	13	15

EXISTING TRAFFIC VOLUMES, 1963
A.M. Peak Hour

FIGURE 2

EXISTING TRAFFIC VOLUMES, 1963

P.M. Peak Hour

FIGURE 3

1. There is a remarkable similarity between A.M. and P.M. peak-hour volumes. This may suggest that the P.M. peak-hour volume, which normally would be greatest, is inhibited by capacity restrictions.

2. Significant turning movements occur at the intersections of Park, Boylston, and Stuart Streets with Tremont Street. It is estimated that about one-third of the traffic approaching any one of these intersections on Tremont Street turns west upon reaching the intersection. This indicates the importance of its distributive function as compared with its function as a through route.

3. Turning movements of an even greater magnitude are found around the Public Gardens, where traffic must execute one-half of a figure "8" in order to travel to or from Back Bay. Only at the Central Artery connections do turning volumes of similar magnitude occur.

4. Vehicles crossing the Fort Point Channel bridges have a directional distribution opposed to that normally expected during peak hours, i.e., *inbound* to the CBD during the P.M. peak. This is indicative of the extent to which through traffic (non-CBD traffic) is using CBD streets and approaches to move around the city.

5. Northbound traffic generally avoids Dewey Square, although Dewey Square serves as a significant focal point for southeastbound traffic and is the location of a large number of turning movements as indicated.

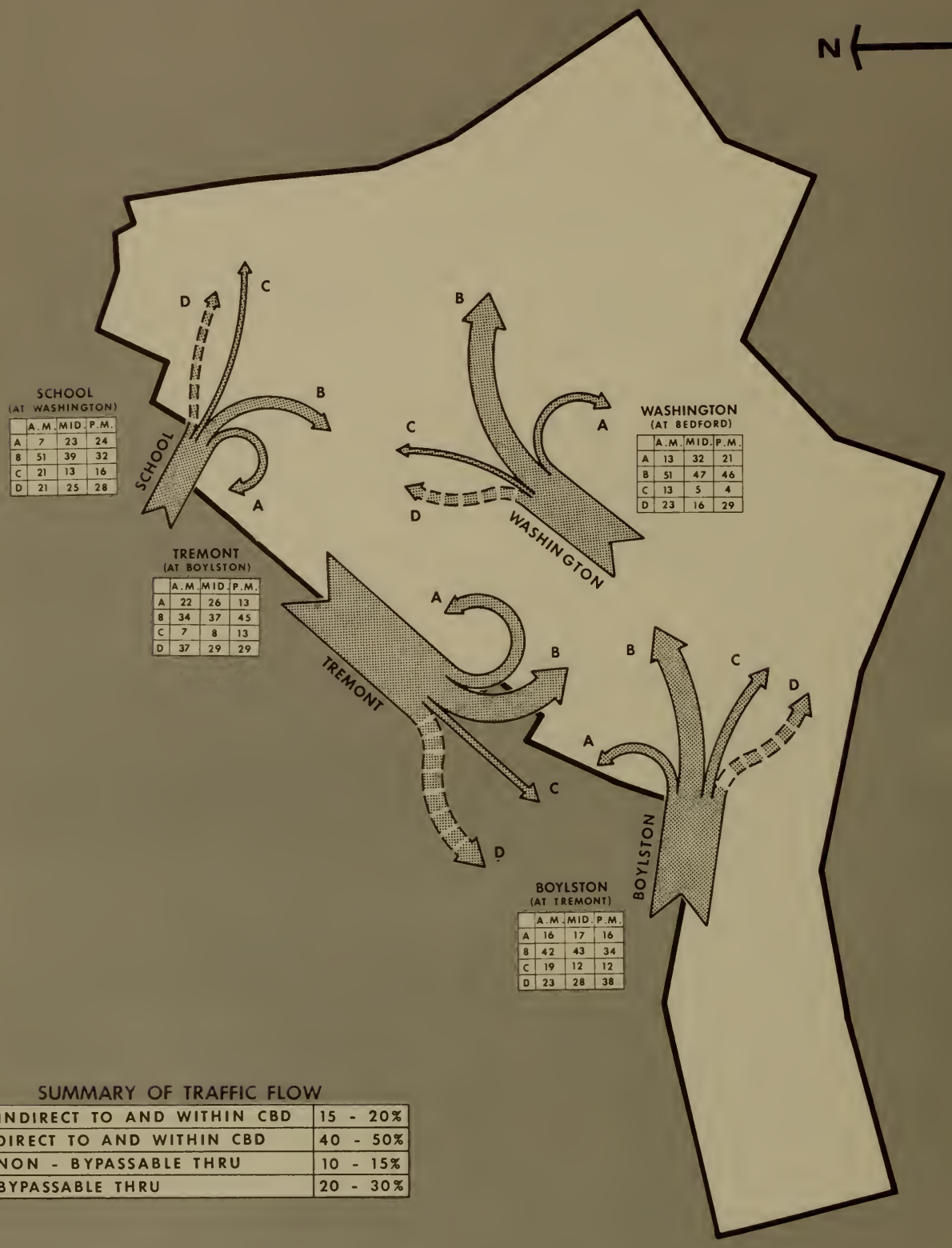
6. There are heavy movements between portions of Boston south and east of the CBD and the north which use the Central Artery because of its location and apparent capacity.

In order to obtain additional information on traffic flow, streetside interviews were conducted at four locations in the CBD from 7:00 A.M. to 9:00 A.M., 10:00 A.M. to 11:00 A.M., 2:00 P.M. to 3:00 P.M., and 4:00 P.M. to 6:00 P.M. The origin-destination data from these interviews is summarized in Figure 4.

Approximately 45 percent of the persons interviewed at these locations indicated that their trip origins and/or destinations were such that they should *not* have passed the interview station. This 45 percent was composed of 25 percent of the trips which were of a through nature and could or should have bypassed the CBD area and a striking 20 percent of the trips which were illogical--northbound drivers intercepted on southbound streets, etc. (In most similar studies, given more efficient street systems, this figure usually ranges from two to five percent.) Less than 10 percent of the total number of people interviewed indicated that their trip was wholly internal to the Central Business District.

Vehicle classification and trip purpose are summarized in Table 7. A smaller percentage of the drivers who were interviewed at Washington

TRAFFIC MOVEMENTS AT FOUR TYPICAL LOCATIONS, 1963



SUMMARY OF TRAFFIC FLOW

A	INDIRECT TO AND WITHIN CBD	15 - 20%
B	DIRECT TO AND WITHIN CBD	40 - 50%
C	NON - BYPASSABLE THRU	10 - 15%
D	BYPASSABLE THRU	20 - 30%

FIGURE 4

Table 7
VEHICLE CLASSIFICATION AND TRIP PURPOSE AT TRAFFIC INTERVIEW STATIONS

Location	Time	Purpose of Auto Trip			Vehicle Classification		
		Shop	Work	Other	Auto	Taxi	Truck
Tremont at Boylston	A.M.	0%	92%	8%	73%	6%	21%
	Midday	18%	46%	36%	70%	14%	16%
	P.M.	14%	75%	11%	80%	12%	8%
School at Washington	A.M.	13%	70%	17%	78%	13%	9%
	Midday	32%	59%	9%	76%	18%	6%
	P.M.	(Not Available)			(Not Available)		
Boylston at Tremont	A.M.	13%	77%	10%	84%	7%	9%
	Midday	29%	42%	29%	84%	7%	9%
	P.M.	6%	81%	13%	86%	10%	4%
Washington at Bedford	A.M.	14%	76%	10%	70%	11%	19%
	Midday	14%	83%	3%	72%	14%	14%
	P.M.	29%	64%	7%	86%	10%	4%

Street during midday indicated shopping as the trip purpose than those interviewed at other stations. It is also significant that a high proportion of vehicles on Tremont and Washington Streets are trucks. This amounts to approximately 20 percent during the A.M. peak hour and about 15 percent at midday.

The average private passenger car occupancy ratio at all stations was 1.54 persons per vehicle.

More detailed information as to zones of origin and destination is given in Appendix Figure 1 and Appendix Table 1.

Most of the loading and unloading operations of service vehicles in the CBD take place on the streets. The truck accumulation study summarized in Table 8 revealed that less than five percent of service and commercial vehicles used off-street facilities. A series of observations (once each hour) disclosed that from 500 to 600 commercial vehicles were stopped on the streets in the Central Business District during the major portion of the day. Figure 5 illustrates the maximum number of trucks observed at one time at each block in the study area. While exact figures are not available, these data would indicate a normal accumulation of about 700 to 900 commercial vehicles, either moving or stopped, in the CBD.

Curb parking studies revealed that the average duration of stay for commercial vehicles is approximately 20 minutes. A significant number of these trucks are parked (or double-parked) illegally.

TRUCK ACCUMULATIONS, 1963

FIGURE 5

Table 8
TRUCK ACCUMULATIONS BY HOUR AND TYPE

Time	Buses	Taxis		Merchandise Vehicles			Service Vehicles					
		Wait	Load or Unload	Semi-Truck	Body Truck	Food and Misc.	Utilities	Municipal	Mail	Clean Main.	Other	Total
7 A.M.	15	48	8	9	90	59	15	10	17	8	4	283
8	26	31	13	10	146	71	29	10	30	14	3	383
9	13	62	25	19	217	83	45	20	38	20	3	545
10	19	77	21	18	265	81	46	27	32	22	7	615
11	13	75	30	19	247	80	38	16	29	9	8	564
12 Noon	16	75	17	11	270	73	37	21	26	6	8	560
1 P.M.	21	69	18	16	245	64	31	11	16	13	9	513
2	19	80	16	9	255	61	39	19	19	8	7	532
3	14	73	24	11	252	51	37	12	18	6	8	506
4	17	51	11	12	172	54	22	13	18	7	10	387
5	19	31	7	13	99	61	26	6	8	5	8	283

PARKING FACILITIES AND CHARACTERISTICS OF PARKERS

Adequate off-street parking to accommodate private vehicles used for travel to the CBD is essential if traffic circulation is to be improved and economic activity maintained. Even though the CBD is and should be served by an extensive public transportation system, it must be expected that a large number of visitors will travel in private vehicles. If they cannot be accommodated with off-street parking, they will demand curb space and completely occupy the small amount that can logically be made available for occasional stops. On other streets, they will seriously obstruct the use of lanes needed for traffic movement.

The parking studies which have been conducted indicate that there is an immediate need for at least 1,600 spaces simply to eliminate poor parking practices in the heart of the Central Business District. Projections of expected growth and considerations of plan developments in fringe areas where substantial parking demand is now accommodated, suggests a potential deficiency of nearly 10,000 vehicle spaces. The shortage is especially apparent with respect to short-term and errand type parking. Any policy regarding parking in the CBD must recognize this critical shortage of short-term space and the need for accommodation of the short-term parker.

The *location* of many parking spaces in the CBD is inappropriate. Many of the facilities that do exist are not properly related to the area of demand nor are they related to adequate street capacity and adequate access from the surrounding highway system.

An inventory (in 1963) of existing off-street parking facilities in the Downtown Central Area revealed a total of 11,900 off-street parking spaces (see Figure 6). Peak use of off-street parking facilities was determined from parking receipt surveys and actual counts of vehicles parked.


OFF-STREET PARKING CAPACITY, 1963
N
0 200 400 600
SCALE IN FEET
VEHICLES
1500
1000
500
100
CBD STUDY AREA BOUNDARY EXCLUDING SOUTH STATION AREA
FIGURE 6

Nearly 12,000 cars were parked in off-street facilities during the period of peak accumulation, obviously in excess of the practical supply. Observers noted that due to the parking of vehicles in aisles, ramps, and entrances, the rated capacity of some facilities was exceeded by as much as 15 to 20 percent during this period.[1]

A study of parking duration (parking receipt analysis and field observation) determined that of the 11,900 off-street parkers, 3,200 were short-term parkers (less than five hours) and 8,700 were long-term parkers. This is illustrated in Figure 7. The total number of parked vehicles in an area can be greater than the rated capacity of the area and the figures still show vacant space available. This arises from the fact that while some facilities may have vacant spaces, capacity is exceeded in others.

A study of turnover in typical off-street parking facilities in the Downtown Central Area revealed that turnover rates for the 12-hour period from 7:00 A.M. to 7:00 P.M. were 1.1 for those obviously catering to long-term parking and 2.8 for those accommodating short-term parking. The most flagrant example of facilities being operated in excess of capacity were those catering primarily to long-term parkers.

Arrivals and departures at off-street parking facilities in the Downtown Central Area also were determined from the parking receipt analysis and from field observations. These are shown in Table 9 and disclose that, during the period from 4:30 to 5:00 P.M., autos were discharged from off-street facilities into the circulation system at a rate equivalent to 5,000 vehicles per hour.

An inventory of parking fees at off-street facilities yielded the information shown in Table 10. More detailed data concerning fees for the first hour and all-day rates is shown in Figures 8 and 9.

A survey of curb parking facilities indicated that 850 of the 900 legal curb spaces were occupied during the period of peak accumulation. At the same time, there were 1,950 illegal curb parkers and 300 double parkers in the Downtown Central Area.

A detailed study of curb use at 21 curb faces in the DCA revealed the following turnover rates during a 12-hour period for curb parkers: legal curb, an average of 7.0 cars; illegal curb, 12.0; and double-parked, 16.0. This same study indicated that the parking duration at curb spaces followed the pattern indicated in Table 11.

---

[1]The Downtown Central Area, as defined in Figure 1, is slightly larger than the CBD. The 1964 parking study used the DCA as the reference area and thus the numbers presented in the text and accompanying figures and tables relate to the DCA. However, since the DCA contains the CBD, general statements made with regard to DCA parking can be considered applicable to CBD-related parking also.

PEAK USE OF OFF-STREET PARKING SPACE, 1963

NOTE: SHADED AREAS REFER TO GENERAL AREA OF APPROPRIATE PIE CHART SUMMARY.

FIGURE 7

Table 9
ARRIVAL AND DEPARTURES AT OFF-STREET PARKING FACILITIES

1/2 Hr. Beg. End.	Arrivals	Departures	Net Change In Use
8:00-8:30 A.M.	2,000	100	1,900
8:30	2,400	100	2,300
9:00	800	100	700
9:30	1,900	700	1,200
10:00	700	300	400
10:30	1,400	500	900
11:00	800	600	200
11:30	900	700	200
12:00 Noon	900	700	200
12:30	500	800	- 300
1:00	800	800	0
1:30	900	600	300
2:00	500	600	- 100
2:30	600	1,900	-1,300
3:00	700	2,400	-1,700
3:30	600	1,700	-1,100
4:00	400	1,500	-1,100
4:30	400	2,500	-2,100
5:00	400	700	- 300
5:30-6:00 P.M.	200	800	- 600

Table 10
PARKING FEES IN OFF-STREET FACILITIES

Time Period	Low	Most Frequent	High
First 1/2 hour	$0.25	$0.50	$0.50
First hour	$0.45	$0.75	$1.00
Additional hours	$0.25	$0.50	$1.00
All day	$1.00	$2.00	$3.50
Evenings	$0.50	$1.00-$1.50	$2.00

Table 11
PARKING DURATION, CURB SPACES

	1/2 Hr. or Less	1/2 - 5 Hrs.	More Than 5 Hrs.
Legal curb	37%	60%	3%
Illegal curb	77%	22%	1%
Double park	88%	12%	-

FIRST-HOUR PARKING RATES, 1963

FIGURE 8

ALL-DAY PARKING RATES, 1963

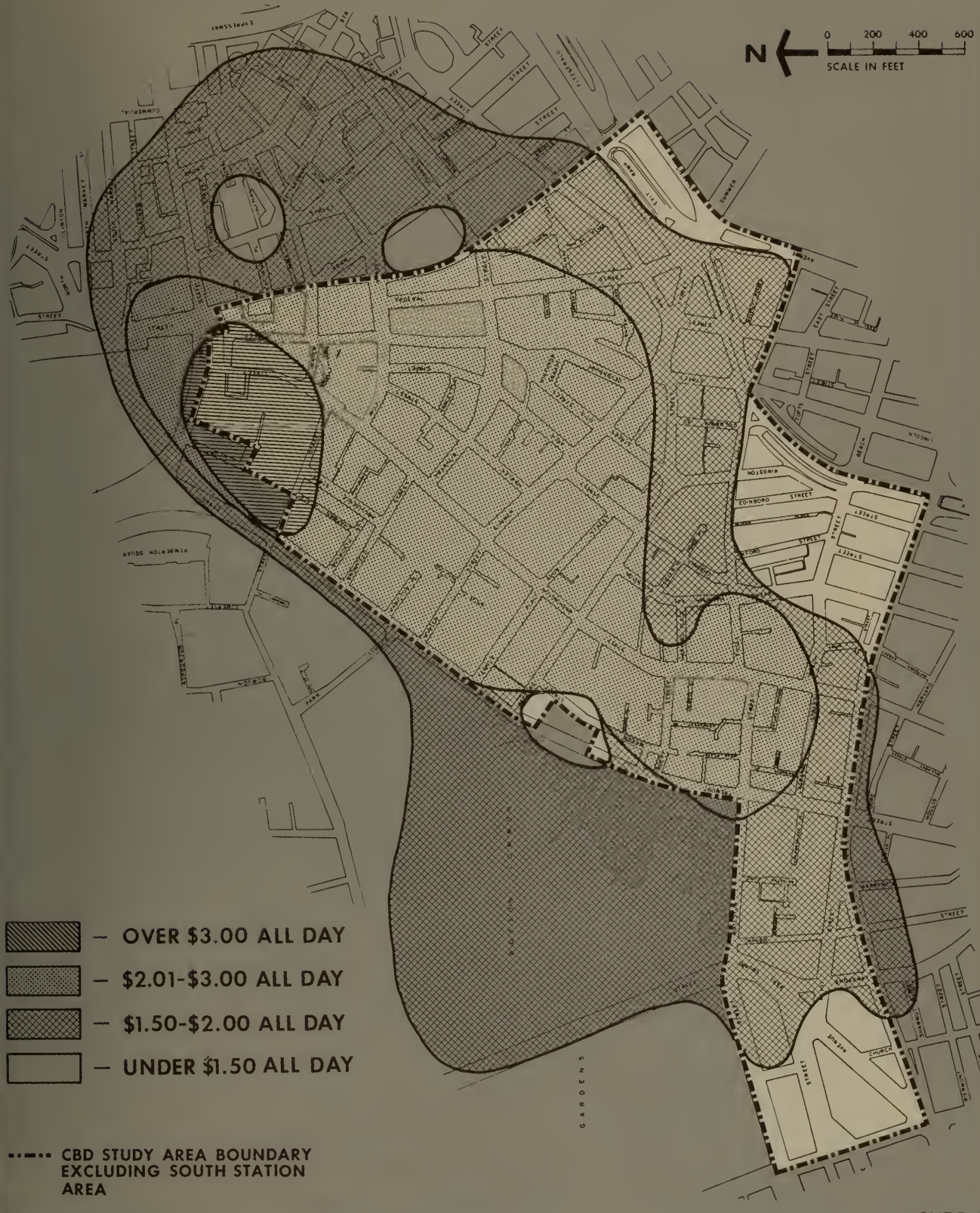


FIGURE 9

Based on a survey of off-street parking in the fringe areas adjacent to the DCA, it was estimated that of 5,900 off-street spaces available, approximately 3,600 are used by DCA-oriented vehicles. The estimated peak occupancy by these DCA-oriented vehicles is 3,000 off-street spaces with 80 percent long-term parking.

The hourly accumulation of parked vehicles in the DCA is shown in Figure 10. The existing supply of parking spaces and peak use of the spaces is summarized in Table 12.

PUBLIC TRANSIT

The public transportation system has serious deficiencies. The CBD is served by four subway tubes traversing the area in a fairly adequate pattern. It is an old system, however, and has been neglected for years. Access to many of the stations is inadequate and transfer from one route to another is inconvenient. The entire system needs to be improved, with some of the stations, entries, and platforms relocated. A better system for interchange of persons between routes and distribution to various CBD locations is needed. A significant deficiency in Boston's transit system and a subsequent handicap to the economy of the Central Business District is the lack of a *surface* transit system to serve short trips in the CBD area. This undoubtedly developed as a result of the narrow, discontinuous street system which will not accommodate a standard bus transit system. Consequently, a special means of shuttling passengers within the CBD should be considered.

These improvements to the public transit system are essential if it is to keep pace with planned highway improvements which will increase the accessibility (by private vehicle) of the Central Business District.[2]

Table 12
EXISTING PARKING SPACE SUPPLY AND PEAK DEMAND

D.C.A.	Existing Spaces	Peak Demand
Off-street	11,900	11,900
Legal curb	900	850
Illegal curb(1)	-	2,250
Subtotal:	12,800	15,000
Fringe (off-street)	3,600	3,000
Total:	16,400	18,000

(1) Includes double-parkers.

[2] Proposed improvements in MBTA facilities are discussed in Chapter 3.

ACCUMULATION OF PARKED VEHICLES, 1963

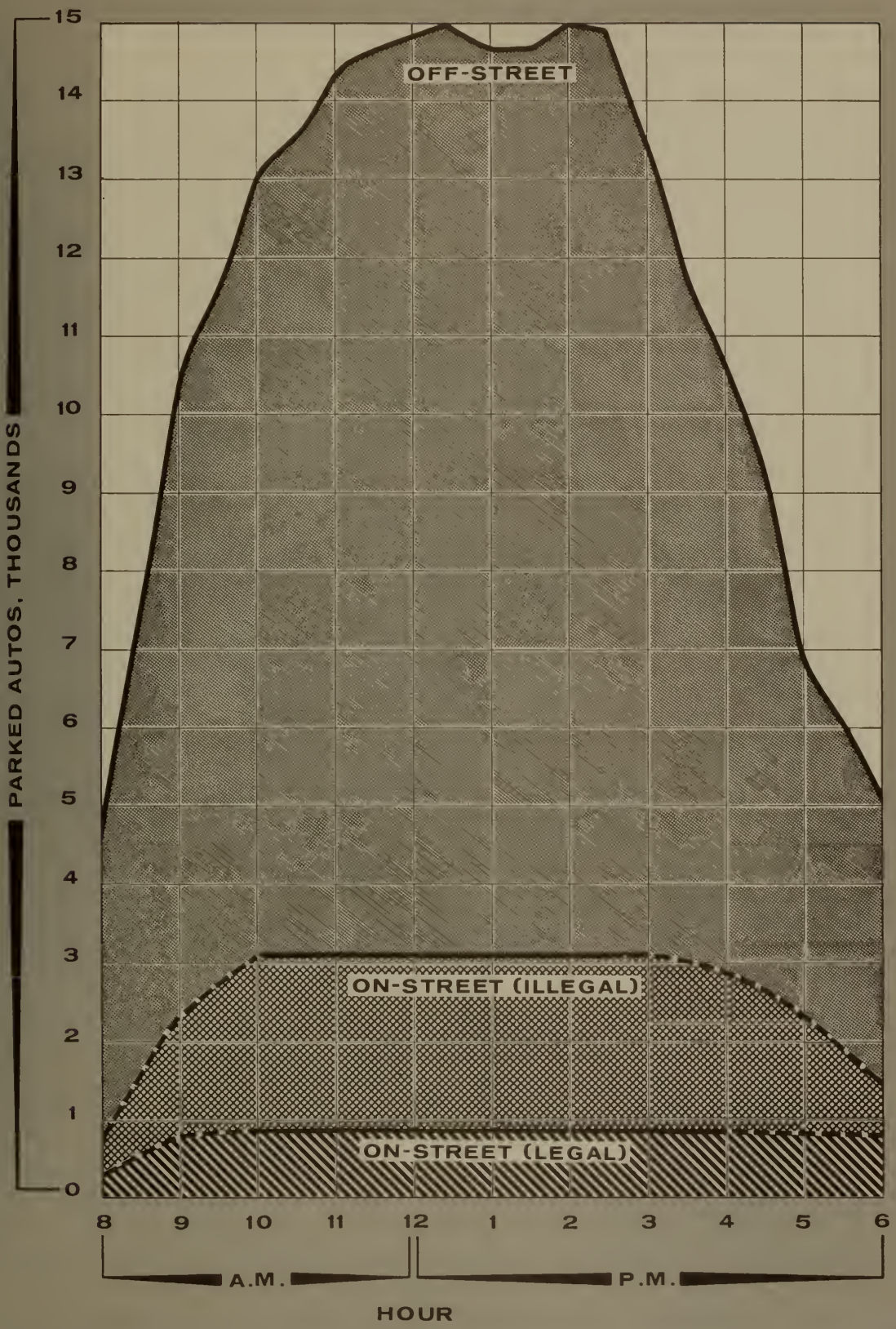


FIGURE 10

The *average* number of daily one-way trips made to the Downtown Central Area[3] via mass transit is shown in Figure 11. A general measure of rapid transit volumes was determined both from line counts and the fares paid at the various stations.

A significantly greater number of rapid transit passengers approach from the south and west than from the north. Railroad passenger volumes, however, are more equally divided with approximately 11,000 arriving at North Station and 5,000-6,000 at South Station, under existing operating arrangements.

Bus passengers use the facilities of 14 bus companies for transportation to the Downtown Central Area. The majority of these persons arrive in the Park Square area, utilizing three terminals and the on-street bus stops of the Egleston M.T.A. line. The North Station-South Station shuttle is the only direct public transportation system providing service through the study area; all other lines terminate on the periphery.

PEDESTRIAN CIRCULATION

Another factor contributing to deficiencies in the circulation system is the inadequacy of sidewalks in certain portions of the CBD to handle major pedestrian volumes at critical points. Sidewalks are an important element of the total transportation system and cannot be dismissed lightly, especially in view of the adverse effect poor pedestrian circulation can have on both street capacity and vehicle circulation. The most critical location in this respect is the intersection of Summer-Winter Street with Washington Street. All along Washington Street from Boylston-Essex to School Street, sidewalk space is insufficient to contain the total pedestrian movement. The inevitable outcome is an overflow into the existing roadway. Similar conditions prevail along School Street, Bromfield Street, Winter Street, and Temple Place. Pedestrians crossing at Tremont and Beacon, Tremont and Park, and Tremont and Boylston often find the sidewalk capacity inadequate. For even moderate levels of pedestrian traffic in an active retail commercial center, 10-foot sidewalks are an absolute minimum and in many instances widths up to 20 feet may be needed. Typically deficient sidewalk widths in central Boston are shown in Table 13.

Pedestrian volumes in the Central Business District were observed during the noon and P.M. pedestrian peak hours (see Figure 12). There is a significant similarity between these peak hours; in both, the heaviest volumes were concentrated near the intersection of Summer, Winter, and Washington Streets. The heavy concentrations near this major retail area of Boston, which also marks the intersection of three subway routes, serve to point out those locations where greatest demands are made on available sidewalk widths.

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[3]The DCA is used as the reference area for the remaining discussion of Public Transit.

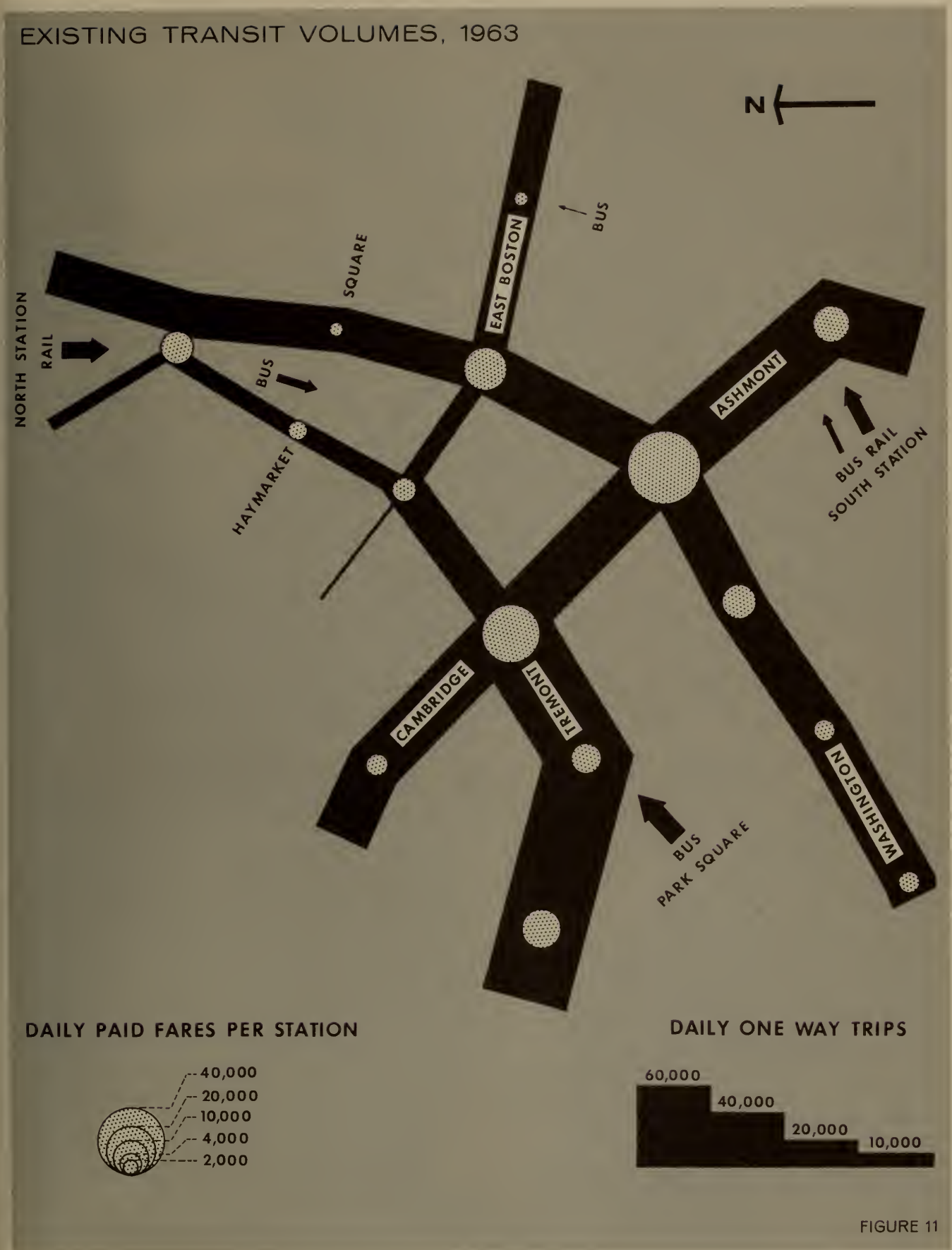
EXISTING TRANSIT VOLUMES, 1963
N
NORTH STATION
RAIL
BUS
SQUARE
EAST BOSTON
BUS
HAYMARKET
ASHMONT
BUS RAIL
SOUTH STATION
CAMBRIDGE
TREMONT
WASHINGTON
BUS
PARK SQUARE
DAILY PAID FARES PER STATION
40,000
20,000
10,000
4,000
2,000
DAILY ONE WAY TRIPS
60,000
40,000
20,000
10,000

FIGURE 11

PEDESTRIAN VOLUMES, 1963

FIGURE 12

Table 13
SIDEWALKS BELOW MINIMUM ACCEPTABLE WIDTH
FOR PEDESTRIAN CONCENTRATION AREAS

Street	Side	At	Sidewalk Width (Feet)
Arch	Both	Summer	8
Bedford	Both	Washington	7
Boylston	Both	Washington	8
Bromfield	Both	Washington	6
Devonshire	Both	Milk	8
Franklin	S	Washington	6
LaGrange	Both	Tremont	6
Milk	S	Washington	8
State	Both	Washington	8
Washington	E	State	8
Washington	W	Summer	9
Washington	W	Temple Place	8
Washington	E	Essex	9
West	Both	Washington	7
Winter	S	Tremont	8

Pedestrian interviews at locations throughout the Central Business District provided data on zone-to-zone movements during the noon and evening peak hours (see Appendix Figures 2 and 3) and the linkages with the 100 percent corner[4] for shopping and non-shopping trips (see Appendix Figures 4, 5, 6, and 7). (Any comparison of zone-to-zone movements must consider the significant differences in zone size.)

Pedestrians also were interviewed to determine their purpose for being in the Central Business District as well as the reason for the immediate walking trip. This data is summarized in Table 14. Additional interviews were conducted at the 100 percent corner to ascertain the primary mode of transportation used by persons to get to the CBD. The close proximity of rapid transit facilities serves to explain the fact that 70 percent of the persons interviewed at this location indicated transit as their mode of travel. (See Table 15.) The distance traveled from home (by mode of transportation) to the 100 percent corner was also determined and is shown in Figure 13.

Auto users were questioned as to where they parked and this information combined with the pedestrian interviews on origin and destination indicates that regardless of purpose of trip or mode of transportation, the median walking distance of pedestrians in the Central Business District is approximately 1,000 feet. (See Figure 14.)

[4]That location generally regarded as the center of the retail core.

Table 14
PRIMARY VS. IMMEDIATE WALKING TRIP PURPOSE
BASED ON AREA PEDESTRIAN INTERVIEWS

	Immediate Trip Purpose	Primary Purpose for Being in CBD			
		Work	Shop	Business	Other
Noon-1:00 P.M.	Work	6%	-	1%	1%
	Shop	16%	75%	12%	7%
	Business	11%	4%	52%	2%
	Lunch	62%	8%	25%	13%
	Other	5%	13%	10%	77%
	Total:	100%	100%	100%	100%
	All Immediate Trip Purposes	67%	15%	12%	6%
4:30 P.M.-5:30 P.M.	Work	3%	3%	1%	1%
	Shop	16%	56%	9%	12%
	Business	9%	1%	40%	3%
	Home	50%	18%	17%	61%
	Other	22%	22%	33%	23%
	Total:	100%	100%	100%	100%
	All Immediate Trip Purposes	74%	11%	5%	10%

Table 15
MODE OF TRANSPORTATION VS. PRIMARY TRIP PURPOSE
BASED ON PEDESTRIAN INTERVIEWS AT 100 PERCENT CORNER

Mode of Transportation	Shop	Business	Work	Other	Total
Auto	11%	31%	13%	16%	14%
Transit	79%	47%	72%	42%	70%
Taxi	1%	13%	1%	5%	3%
Drop-off	2%	3%	3%	0%	2%
Walk	7%	6%	11%	37%	11%
Total:	100%	100%	100%	100%	100%
(All modes	49%	11%	31%	9%	100%)

PRIMARY TRAVEL MODE VS. TRIP DISTANCE,
DOWNTOWN PEDESTRIANS, 1963

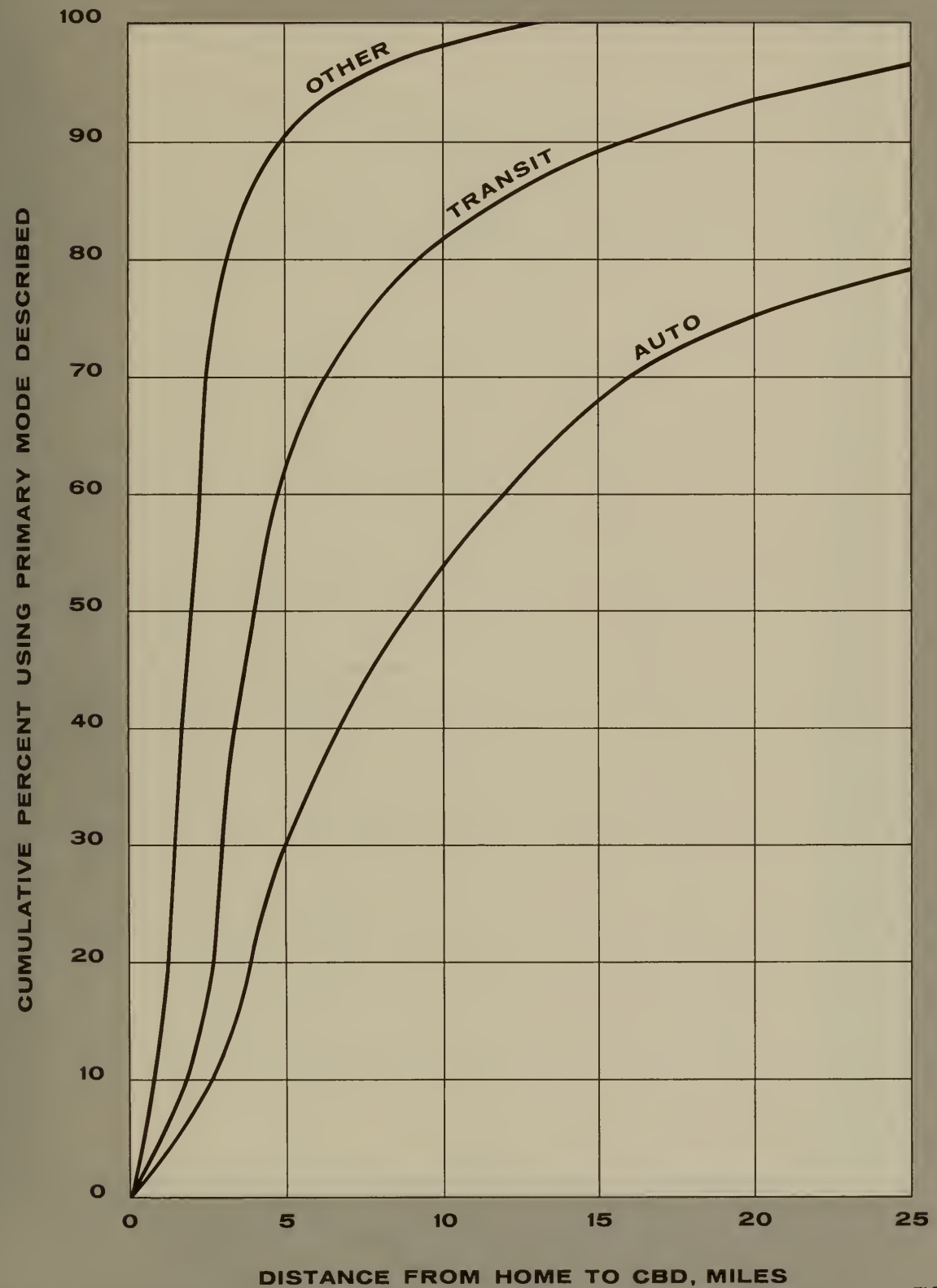

FIGURE 13

PEDESTRIAN WALKING DISTANCES, 1963

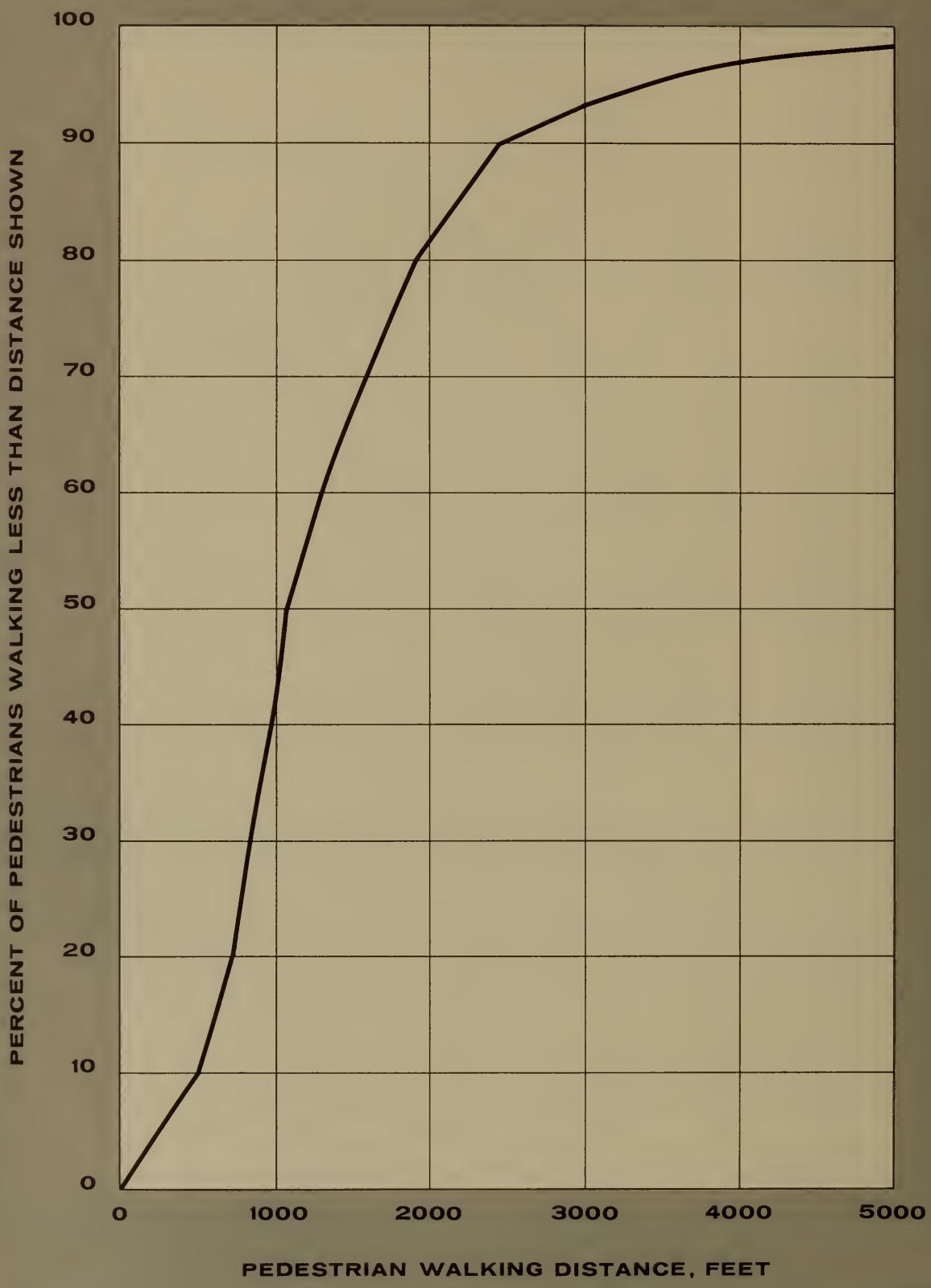

FIGURE 14

CONCLUSION

The analysis of existing conditions indicates that the street, parking, and transit system of the Central Business District is seriously deficient when measured against modern standards. As such, the present street system inevitably retards the growth and economic health of the area. It constitutes a major element contributing to substandard conditions and environmental blight throughout the entire Central Business District. One of the basic ingredients of a healthy CBD is its accessibility. To such extent as this accessibility is improved, the general well-being of the area can be expected to improve. To such extent that it is left substandard and deficient, it must be expected to continue as a blighting influence.

2
INVENTORY AND ANALYSIS OF PROJECTS PROPOSED BY PUBLIC AGENCIES

THE IMPROVEMENT projects of state, metropolitan, and local transportation agencies will affect the accessibility of the Central Business District. The location of these improvements may have a significant bearing upon the movement of persons from one part of the region to another, or they may change significantly the pattern of approach into and out of the Central Business District. However, the long-range effect probably will be to stimulate increases in both motor vehicle traffic and use of mass transportation.

Planning and designing for the Central Business District of Boston must acknowledge and account for expected changes in the regional transportation system. Many projects of the Massachusetts Department of Public Works, the Massachusetts Bay Transportation Authority, the Metropolitan District Commission, the Boston Public Works Department, the Boston Traffic and Parking Department, and the plans and expectations of private railroad and bus companies have been accepted as public policy. These accepted projects must be assumed as components of the future transport network. Others, although not yet fully *accepted* or financed, have been *recommended* as necessary and desirable by various agencies. These, too, must be assumed as valid projects unless they are eliminated by appropriate governmental agencies. There is a third category of plans and projects that have been *suggested* in the recent past but have not received general acceptance. These improvements cannot be *assumed* as elements of the future regional network but must be acknowledged and given consideration.

The "accepted," "recommended," and "suggested" improvements are described below (no improvements in the "recommended" category are applicable to expressways).

EXPRESSWAYS

The expressway program for the Boston Metropolitan Region has been planned and programmed by the Massachusetts Department of Public Works. All of its components, as described in numerous reports, have been accepted and assumed in this study of the Central Business District as elements of the future transportation network. They are:

Accepted

1. The Inner Belt in its entirety from Charlestown to Roxbury.

2. I-95 (the Northeast Expressway) fully completed from the Central Artery to the New Hampshire State Line.

3. I-93 (the Northern Expressway) completed from the Inner Belt in Charlestown to the New Hampshire State Line.

4. Route 3 from the Inner Belt to the New Hampshire State Line.

5. I-95 (Southwest Expressway) from the Inner Belt to the Rhode Island State Line.

6. Southeast Expressway and Route 3 completed from the Central Artery to Cape Cod.

7. Route 128 as reconstructed.

8. I-495 (Outer Circumferential).

Suggested

1. The Intermediate Belt, which is suggested as a circumferential, roughly midway between the Inner Belt and Route 128. This proposal has not received official recognition.

2. Expressway from Sullivan Square across Cambridge, the Charles River, the Back Bay, and the South End, to the Central Artery at Boston City Hospital. This proposal is not being actively pursued by any agency.

3. New harbor crossing, probably in a tunnel and probably running from the present interchange of the Massachusetts Turnpike at South Station to East Boston in the vicinity of Logan Airport.

Effect of Expressways Upon Downtown Boston

The construction of multi-lane, limited-access expressways, which are part of the Interstate System as well as components of the state highway network, will have a three-fold impact upon travel to and from the Central Business District.

First, the circumferential Inner Belt, acting as both a collector-distributor and connector for the radial expressways, will divert large volumes of motor vehicles that now travel through Downtown Boston, primarily on the Central Artery and Storrow Drive. The Inner Belt will provide an alternate (and better) route for moving from one side of the Metropolitan Area to the other (it will not eliminate all through traffic from either the Central Artery or Storrow Drive). The relocation of this

through-traffic movement from the Central Artery to the Inner Belt will provide additional capacity for vehicles with origins and destinations in the Downtown Boston area. A high proportion of these additional vehicles will be bound for the CBD project area, provided that adequate parking facilities are made available.

Second, although construction of radial expressways has progressed reasonably well in Metropolitan Boston, three facilities are yet to be completed and joined with the Inner Expressway System (the Central Artery and the Inner Belt). Their completion will provide many additional high-speed lanes oriented towards Downtown Boston. A good proportion of these lanes can be expected to carry vehicles to the CBD, restricted only by the limitation of the expressways, arterials, and circulation and parking systems serving the CBD itself. Barring traffic congestion, all sectors of the Metropolitan Area and the fringe areas beyond will be within a few minutes driving time of Downtown Boston.

A third significant aspect of completion of the regional expressway network is a substantial reduction of traffic congestion on surface streets and highways. With respect to the Central Business District, the effect will be much improved vehicular accessibility on streets and highways because of the diversion of many motorists to the expressway network. The Inner Belt Circumferential, in particular, will relieve crosstown streets of a large proportion of existing traffic volumes, thus reducing the intersection conflicts created by motor vehicles traveling circumferentially and radially. It is to be expected that the volume of radial movements on streets and highways can be increased. Again, much of this movement is already oriented towards the Downtown Boston area.

MAJOR HIGHWAYS

The major highways of the Boston Metropolitan Region are planned, financed, constructed, and maintained by local, regional, and state public agencies. The majority of these highways have direct or indirect effect upon the accessibility of Downtown Boston to the remainder of the Metropolitan Area. Each new highway or major street improves the capacity of a link in the entire network and thereby increases the efficiency of movement into Downtown Boston and allows existing streets to handle travel oriented to the center of the metropolis more efficiently.

Because of multi-agency authority and responsibility (and because a smaller proportion of federal aid is available for these types of improvements) many projects have a priority less than fully "accepted." More projects remain in the "recommended" and "suggested" categories, not because of their lack of necessity, but because financing opportunities have not been clarified.

Those projects that will tend to improve the flow of vehicles to and from the CBD project from all reaches of the Metropolitan Area, are as follows (dates indicate estimated time of completion):

Accepted

1. Rutherford Avenue--Warren Avenue Bridge--Under Artery Highway to Haymarket Square (1969).

2. City Square--Leveritt Circle Bridge and improvements to Chelsea-Water Street (Charlestown) and Mystic River Ramps (1969).

3. Albany Street relocation from East Berkeley Street (formerly Dover Street) to Massachusetts Avenue in the South End (1970).

4. Route 2 reconstruction from Route 128 to Alewife Brook Parkway (1969).

5. Jamaicaway--Riverway improvements from Jamaica Pond to Brookline Avenue (1967).

6. Relocated and improved Atlantic Avenue from Northern Avenue to North Station.

7. The Government Center Circulation Plan (1969).

Recommended

1. Massachusetts Turnpike Extension Service Roads from Albany Street to Dartmouth Street (1969).

2. Jamaicaway-Riverway improvements from Brookline Avenue to Inner Belt (1972).

3. Changes in South End-South Cove Street System, including South End Bypass from the Inner Belt to Dartmouth Street (1972).

4. Prison Point Bridge reconstruction.

5. Dorchester Avenue extension from South Bay Area to Atlantic Avenue, north of Northern Avenue (1972).

6. Reconstruction of C-1 from East Boston Expressway to I-95 and Revere Marshes (1970).

Suggested

1. Charles River Dam--Northern Artery Viaduct from Lechmere Square over Leveritt Circle.

Effect of Major Highways Upon Downtown Boston

Many of the above projects now programmed for construction within the next six or seven years not only will complement the regional expressway system and add additional capacity to the existing street system surround-

ing the CBD area, but also will help relieve significant bottlenecks and make it possible for other roads to provide better accessibility to the CBD project area. Most of these projects are in areas adjacent to the Central Business District. Only one, the Government Center Circulation Plan, contains projects that are contiguous to the CBD project. Most of the others mentioned do create radial and circumferential capacity increases in the street system close enough to the project area to cause a distinct capacity increase potential into and around the CBD. Each must be technically evaluated individually to ascertain the full impact.

MASS TRANSPORTATION

Without qualification, the major mass transportation facilities in Metropolitan Boston are oriented towards and serve the Downtown Boston Area. In fact, the majority of mass transportation users have destinations within Downtown Boston and the greatest proportion of these have destinations within the CBD project area. Thus all mass transportation improvements or changes have a direct bearing upon travel of persons to and from the CBD.

During the past one and one-half decades, the mass transportation system has been improved by only two major extensions of rapid transit facilities: the East Boston Extension to Revere and the Highland Branch Extension to Riverside. However, recent events allow more positive attitudes about the possibility of additional transit improvements throughout the region. A most recent example of this is the approval by the General Court of Massachusetts to finance an additional extension to the north and for studies of three other extensions throughout the Metropolitan Area.

Recently the MBTA has undertaken a comprehensive, coordinated planning effort which places transit needs in better balance with those of highways and, in turn, relates both transit and highways to total regional growth trends and potentials. This effort has resulted in a program of action projects which will meet the most pressing problems of the present and begin to meet the needs of the future while providing for continuing studies on the longer-range transit problems. These action projects will provide the following:

1. Five new rapid transit extensions and major improvement of a sixth.

2. Air conditioning and other modernization of existing rapid transit vehicles on the Forest Hills-Everett and Cambridge-Dorchester lines, and replacement of obsolete East Boston rapid transit vehicles.

3. Removal of all seven miles of the elevated portions of the Forest Hills-Charlestown-Everett line.

4. Construction of 29 miles of electrified rapid transit routes.

5. Construction of 25 new rapid transit stations and modernization of all existing stations that will remain.

6. A substantial program of replacement of obsolete surface vehicles and garages.

7. An increase to approximately 450 rapid transit vehicles from the present 264 vehicles.

8. An increase to approximately 25,000 parking spaces from the Authority's present 6,284 parking spaces.

Because the Boston Area already has an extensive system of rapid transit lines operating on established rights-of-way, a complete new system freshly conceived and built is not feasible. The future transit system then will be composed of elements that are additions to the existing system and other elements that are systematic replacements of present elements. Figure 15 illustrates the location and extent of new and upgraded lines and stations in the Boston Metropolitan Area. Further details concerning MBTA's Action Project program can be found in their *Program for Mass Transportation* and *Staff Supplementary Report to the Program for Mass Transportation*, published in Ausust, 1966.

Effect of Mass Transportation Improvements Upon Downtown Boston

The extension of rapid transit service into areas of Metropolitan Boston now served by infrequent railroad commuter trains is expected to attract a greater number of persons into Downtown Boston. Equally important, mass transit improvements will contribute to a more balanced transportation system and help relieve some of the pressures for vehicular access to the CBD area.

DOWNTOWN OFF-STREET PARKING FACILITIES

As part of its capital improvement program, the City of Boston intends to construct (or encourage construction of) a number of off-street parking facilities in and around the Downtown Boston Area. At present, there has been no stated policy as to the function (use characteristics) or rate structures of these facilities:

Accepted

1. Government Center Parking Terminal, 2,000 spaces (1968).

2. South Station Parking Terminal, 5,200 spaces (1968).

Recommended

1. Central Business District, 5,500 spaces (1969).
2. Back Bay, 500 spaces (1969).

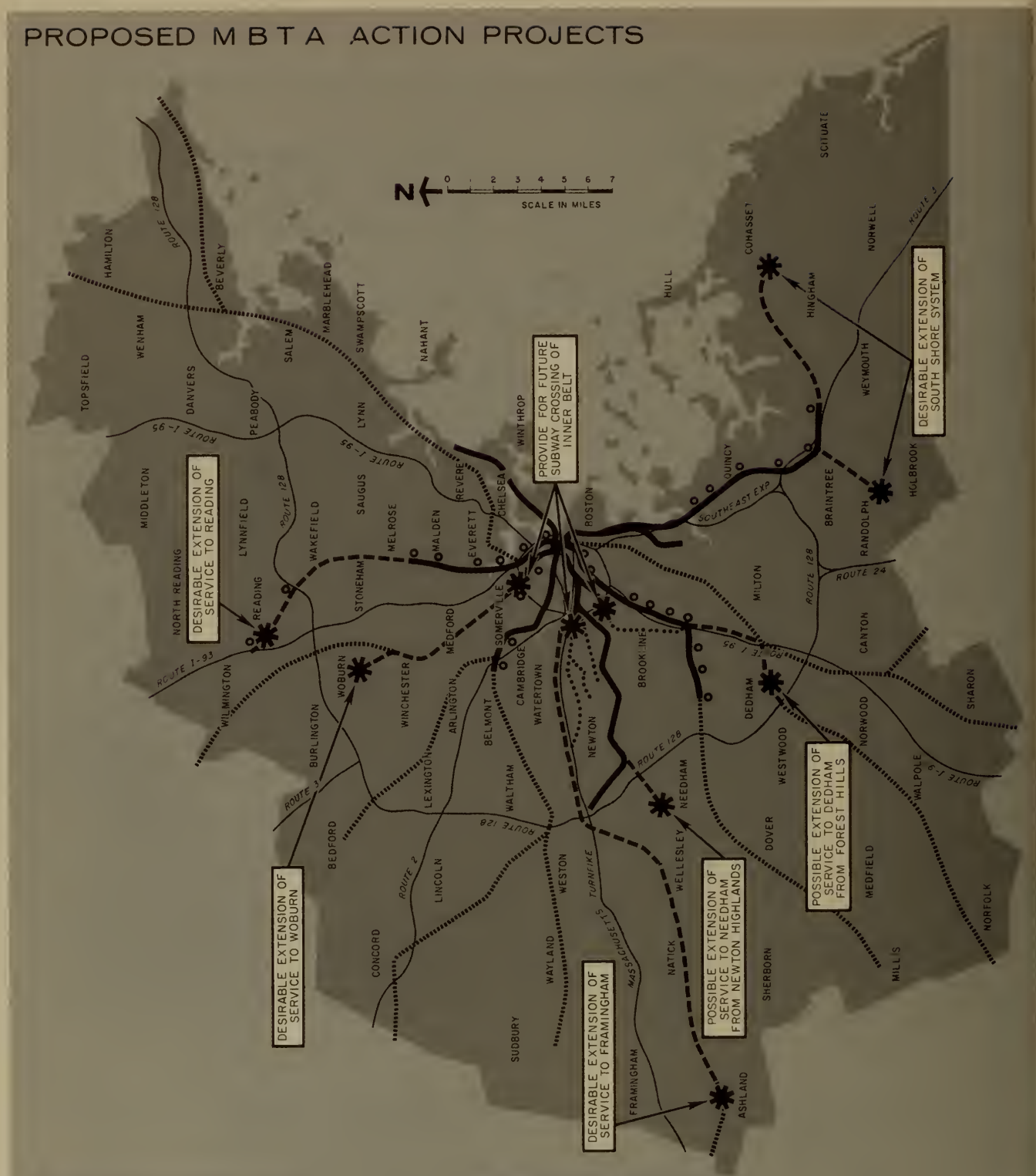
PROPOSED M B T A ACTION PROJECTS
N
0 1 2 3 4 5 6 7
SCALE IN MILES
DESIRABLE EXTENSION OF SERVICE TO READING
PROVIDE FOR FUTURE SUBWAY CROSSING OF INNER BELT
DESIRABLE EXTENSION OF SOUTH SHORE SYSTEM
DESIRABLE EXTENSION OF SERVICE TO WOBURN
DESIRABLE EXTENSION OF SERVICE TO FRAMINGHAM
POSSIBLE EXTENSION OF SERVICE TO NEEDHAM FROM NEWTON HIGHLANDS
POSSIBLE EXTENSION OF SERVICE TO DEDHAM FROM FOREST HILLS
TOPSFIELD
HAMILTON
WENHAM
BEVERLY
DANVERS
SALEM
MARBLEHEAD
SWAMPSCOTT
NAHANT
HULL
SCITUATE
COHASSET
HINGHAM
NORWELL
WEYMOUTH
MIDDLETON
NORTH READING
READING
LYNNFIELD
PEABODY
LYNN
WAKEFIELD
SAUGUS
MELROSE
STONEHAM
MALDEN
REVERE
EVERETT
CHELSEA
WINTHROP
ROSTON
QUINCY
BRAINTREE
HOLBROOK
RANDOLPH
MILTON
CANTON
SOMERVILLE
MEDFORD
BROOKLINE
DEDHAM
SHARON
WILMINGTON
WOBURN
WINCHESTER
ARLINGTON
BELMONT
CAMBRIDGE
WATERTOWN
NEWTON
NEEDHAM
WESTWOOD
NORWOOD
WALPOLE
BURLINGTON
LEXINGTON
WALTHAM
BEDFORD
CONCORD
LINCOLN
WESTON
WAYLAND
SUDBURY
NATICK
WELLESLEY
DOVER
SHERBORN
MEDFIELD
MILLIS
NORFOLK
FRAMINGHAM
ASHLAND
ROUTE 1-95
ROUTE 128
ROUTE 24
ROUTE 3
ROUTE 2
SOUTHEAST EXP
MASSACHUSETTS TURNPIKE
FEATURES OF MBTA PLAN
EXISTING AND PROPOSED RAPID TRANSIT LINE
EXISTING STREET CAR LINE
EXISTING AND PROPOSED HIGHWAY SYSTEM
POSSIBLE RAIL SERVICE
NEW STATION
PROPOSED ADDITIONS TO MBTA PLAN
DESIRABLE EXTENTIONS AND AUGMENTATIONS

FIGURE 15

3. Waterfront Project, 1,700 spaces (1968).

4. Huntington Avenue, 500 spaces (1969).

5. South End-City Hospital, 1,500 spaces (1969).

6. South Cove, 1,000 spaces (1969).

7. Massachusetts Avenue, 500 spaces (1969).

8. Kenmore Square, 800 spaces (1969).

Effect of Off-Street Parking Upon Downtown Boston

Quite clearly, creation of the number of spaces described above will encourage additional persons to travel to Downtown Boston by motor vehicle. The locations of the facilities will tend to distribute the increase in motor vehicles throughout the Downtown Boston Area.

It is impossible to define the exact impact until the locations and use requirements are specified.

3
EXISTING AND FUTURE TRAVEL CHARACTERISTICS

THE MAGNITUDE and characteristics of the many types of existing (and projected future) trips made to Downtown Boston served as initial design guides for the Downtown Boston circulation and parking study. They were modified and refined as additional travel and land development information became available.

These values have been analyzed in order to establish criteria to be used in the development of circulation plans for the Boston Central Business District. These criteria help assure that the CBD street, highway, parking, and mass transit development program is consistent with the travel habits of the 3.5 million people in Metropolitan Boston and the additional millions elsewhere in New England.

The assembly of this planning criteria data has included review and analysis of all existing studies on the subject (see list of reference material in Appendix Table 2) and numerous special studies undertaken in cooperation with the Boston Redevelopment Authority, the Boston Parking and Traffic Department, and the Boston Police Department. Additional information was obtained from studies undertaken in many large cities throughout the country.

FUTURE PERSON-TRIPS TO DOWNTOWN BOSTON

The number of people who travel into Downtown Boston[1] during an average day is estimated to be 385,000. These person-trips represent the one-way movement *into* Downtown Boston each day. The figure does not include walking trips, trips that pass *through* the Downtown Area, or those trips that take place *within* the area.

The amount of travel to Downtown Boston in the future can be expected (as a minimum) to increase in proportion to the amount of additional de-

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[1] As established in the *Introduction*, Downtown Boston is that area of the Boston peninsula lying northeast of Massachusetts Avenue and bounded by the Charles River, Boston Harbor, and the Fort Point Channel. This area is also referred to at times as Boston Proper.

velopment occurring within the area. For each new building that places an additional square foot of space (office, retail, wholesale, or other types of uses) within the Downtown Area, there will be additional travel by automobile, truck, and mass transit.

The amounts of each type of travel will depend on the amount of new development, its location, and the use to which it will be devoted. The Boston Redevelopment Authority Master Plan and other recent studies have estimated a growth factor in Downtown Boston of 12 to 20 percent by 1980. This growth generally reflects the expansion in metropolitan population and economy expected by 1980. Although growth in Downtown Boston may be less or greater than the estimates (depending upon local taxing policies, transportation improvements, and other influences) in very general terms, a 12 to 20 percent expansion appears to be a valid range for guiding transportation planning.

This expansion will cause an additional 50,000 to 80,000 persons to travel to Downtown Boston each day. If Downtown Boston achieves the maximum expected growth potential (20 percent), the total travel would then become 462,000 one-way person-trips per day. Unquestionably, additional trips would be attracted to the downtown if transportation facilities were created to provide better than normal accessibility (i.e., if off-street parking spaces were constructed in choice locations, or if rapid transit facilities were made far more convenient) and total travel would exceed the values quoted above. On the other hand, if transportation facilities are inadequate in capacity and convenience, the amount of travel will be less than the quantity stated above.

MODAL SPLIT OF PERSON-TRAVEL TO DOWNTOWN BOSTON

The type of transportation used by persons traveling to (or from) Downtown Boston is shown in Table 16.

These estimates have been assembled by a review of cordon count data, data assembled by the Eastern Massachusetts Regional Planning Project, and MBTA information. A review of the most recent data available shows that transit use in Boston appears to be following the national trend and is declining. The Action Projects proposed by MBTA should reverse, or at least stabilize, this trend. Concurrently, motor vehicle travel to the Downtown Area appears to be increasing steadily, partly because of the opening of the Callahan Tunnel and the Massachusetts Turnpike Extension.

The future mode of travel to Downtown Boston and the Central Business District Project Area will be conditioned primarily by the capacity and convenience of the future network of facilities serving the area. During the past 15 years the major improvements to the transportation system have been in the form of creating new automobile facilities (i.e., Mystic River Bridge and the Northeast Expressway, Storrow Drive, the Southeast Expressway, the Central Artery, the Callahan Tunnel and East Boston Expressway, and the Massachusetts Turnpike Extension). These facilities

Table 16
EXISTING PERSON-TRIPS TO DOWNTOWN BOSTON BY MODE

Mode		Person-Trips
Motor Vehicles		210,700
Automobile trips (1.54 occupants per vehicle)	123,500(1)	
Truck trips (1.2 occupants per vehicle)	16,500(1)	
Total Vehicle Trips:	140,000(1)	
Mass Transportation		174,500
MBTA Rail	136,000	
Railroad	21,000	
Bus (including MBTA)	17,500	
	Total Person-Trips:	385,200

(1) Derived from information presented in Appendix Table 3, assuming 50 percent of truck, taxi, and school bus passenger trips are made by auto and 50 percent are made by truck.

plus many local improvements have created a significant increase in the capacity of access routes serving the downtown and, accordingly, a distinct and steady increase in automobile use.

During the same period the improvements to the transit system have been fewer and the competitive position of transit has diminished sharply.

The emphasis on automobiles is expected to continue in the future. Projects now contemplated for completion within five years will contribute to a total automobile system containing a capacity of twice that which existed just after World War II.

Unfortunately, the transit system has been adversely affected by the automobile competition and the inability to make comparable improvements. Recent actions by the MBTA indicate that efforts are being made to remedy this situation.

Those improvements that can be expected to increase the capacities of streets leading into and out of Downtown Boston are listed in Table 17. The additional capacities are expected to be fully utilized. The resultant vehicle movement (in one direction) into Downtown Boston in the 1980 period will be increased as shown in Table 18.

Table 17
ESTIMATED ADDITIONAL CAPACITY OF HIGHWAY IMPROVEMENTS

New Facilities	Additional Capacity, One Direction, Per Day
Warren Avenue Bridge	10,000 Vehicles
City Square-Leverett Circle Connection	10,000
Massachusetts Turnpike (three lanes)(1)	60,000
Albany Street Relocation	5,000
Dorchester Avenue Extension	10,000
Total:	95,000 Vehicles

(1)This roadway now exists, having been completed since the study was initiated.

Table 18
VEHICLES ENTERING DOWNTOWN BOSTON, 1980

	Vehicles/Day
Existing (1963) motor vehicles volumes (into Downtown Boston)	140,000
Existing through trips (discussed later)(1)	280,000
Expected new volumes(2)	95,000
Total 1980 Volumes:	515,000

(1)Derived as shown in Appendix Table 4.

(2)Includes Massachusetts Turnpike Extension Volumes.

A substantial portion of the vehicle access capacity serving the Downtown Area is utilized by traffic moving from one side of the downtown to the other, i.e., through traffic. This condition is expected to continue because of the basic design of the expressway network. Applying 1963 origin-destination data to the 1980 volumes, it is estimated that roughly 64 percent of the total 1980 volume will attempt to move *through* the Downtown Area in the future (both directions), while 36 percent will have destinations in Boston Proper.

Rapid transit capacities are not expected to change significantly nor be *fully* utilized. The Action Projects envisioned by MBTA will offer improved facilities, but these improvements are necessary in order that transit arrest its steadily declining role in the Boston transportation system. Transit traffic undoubtedly will increase due to planned extensions and improvements, as well as the abandonment of commuter railroad service to Downtown Boston and the anticipated overall growth of the Downtown Area. But these changes will have little effect upon the existing capacity which exceeds current and expected use. Better use of the available transit capacity is dependent upon improvements that will extend efficient service into the growing suburbs that lie beyond the MBTA district.

The projected (1980) travel to Downtown Boston is summarized in Table 19, by mode.

MODAL SPLIT OF PERSON-TRAVEL PASSING THROUGH DOWNTOWN BOSTON

The basic pattern of the expressway and transit systems of Metropolitan Boston, coupled with the geographic configurations of the land and water bordering the region and the location of Downtown Boston, create conditions which induce relatively large portions of person-travel to pass through the Downtown Area. Persons traveling from Dorchester, Quincy, Malden, etc., to the northeast sector of the Metropolitan Area (i.e., East Boston, Revere, Chelsea, Lynn, and the North Shore) find that the easiest route is the Central Artery, passing through the Downtown Area. This is true also of the transit system which is radial in nature and forces riders to pass through the downtown in order to reach destinations on the other side of the Downtown Area.

Table 19
SUMMARY OF FUTURE TRAVEL PROJECTIONS TO DOWNTOWN BOSTON BY MODE

Mode		Person-Trips
Motor Vehicle		282,000
Automobile trips	165,800[1]	
Truck trips	22,200[1]	
Total Vehicle Trips:	188,000	
Mass Transportation		180,000
MBTA rail	165,000	
Bus (including MBTA)	15,000	
	Total Person-Trips:	462,000

[1] Derived as shown from *Summary of Future Travel Projections* accompanying Appendix Table 4.

The Inner Belt Circumferential route can be expected to help reduce the proportion of vehicular through traffic once it is constructed. The relief created by the Inner Belt will be primarily during the peak hours. Much of the off-peak travel will remain on the Central Artery because of its advantageous location.

Transportation studies indicate that 55 percent of the total person-trips entering the downtown in 1963 were through trips while 45 percent were downtown-destined trips. The distribution of these trips by mode is shown in Table 20.

The future volume of rapid transit riders traveling through the Downtown Area is pertinent to the Central Business District Renewal Project in that adequate capacity must be retained for these trips. However, it is impossible to estimate actual 1980 volumes of through transit riders accurately because they will be influenced by the type and amount of development occurring throughout the Metropolitan Area and the improvements made to the highway system.

ORIGIN OF TOTAL DOWNTOWN-DESTINED PERSON-TRIPS

The origins of trips made from throughout the Boston Metropolitan Area to the Downtown Area and points beyond can be determined from origin and destination data recently made available by the Eastern Massachusetts Regional Planning Project. The results of this study are presented in Table 21, which shows the origin of downtown-destined trips by section and mode. The direction of approach of these downtown-destined trips is illustrated in Figure 16.

The origins of trips made to Downtown Boston from throughout the Metropolitan Area in the future will depend on the patterns of residential and commercial development throughout the Eastern Massachusetts Area. These, in turn, will be influenced by the improvements that occur in the

Table 20
EXISTING (1963) PERSON-TRIPS TO AND THROUGH DOWNTOWN BOSTON BY MODE

Mode		Person-Trips	Percent of Total
To Downtown:			
Motor Vehicle		210,700	
Mass Transportation		174,500	
	Subtotal:	385,200	45.4%
Through Downtown:			
Motor Vehicle		366,250	
Mass Transportation		96,000	
	Subtotal:	462,250	54.6%
	Total:	847,450	100.0%


DIRECTION OF APPROACH
OF DOWNTOWN-DESTINED TRIPS, 1963
N
0
1000
2000
SCALE IN FEET
NORTHEAST
38,000
NORTHERN
56,000
NORTHWEST
39,000
SOUTHERN
87,000
SOUTHWEST
59,000
WESTERN
58,000
CAMBRIDGE

FIGURE 16

Table 21
EXISTING ORIGIN OF DOWNTOWN-DESTINED TRIPS BY SECTION AND MODE

Sectors	Transit Trips	Auto[1] Trips	Total[2] Trips	Percent of Total Flow
Northeast	20,000	18,000	38,000	11.3%
Northern	31,000	25,000	56,000	16.6
Northwest	20,000	19,000	39,000	11.6
Western	29,000	29,000	58,000	17.2
Southwest	36,000	23,000	59,000	17.5
Southern	40,000	47,000	87,000	25.8
Total:	176,000	161,000	337,000	100.0%

Source: EMRPP Data

[1] Includes truck and taxi passengers but not drivers.

[2] Does not include trips from beyond EMRPP external cordon.

Table 22
ESTIMATED ORIGIN AND MODAL SPLIT OF DOWNTOWN-DESTINED PERSON-TRIPS, 1980

Sectors	Number of Transit Trips	Percent of Region	Number of Trips by Motor Vehicle	Percent of Region
Northeast	25,000	13.9%	36,000	12.8%
North	29,800	16.5	46,000	16.3
Northwest	28,200	15.7	38,600	13.7
West	27,000	15.0	46,000	16.3
Southwest	20,000	11.1	29,600	10.5
Southern	50,000	27.8	85,800	30.4
	180,000	100.0%	282,000	100.0%

regional transportation network. The origins of trips to Downtown Boston and estimates of mass transportation use for 1980 and the resultant number of person-trips by motor vehicles are shown in Table 22.

The estimates of transit volumes are dependent upon construction of the transit improvements listed as "accepted" and "recommended" in Chapter 3 dealing with transportation planning projects of metropolitan agencies. Failure to achieve any one of those projects will reduce the number of trips from that sector of the Metropolitan Area which is affected.

DAILY PERSON-TRIPS TO THE CBD PROJECT AREA

The data described below is a preliminary estimate of the travel (by mode) made to the various *parts* of the Central Business District, based upon previous studies of origins and destinations throughout the Metropolitan Area. The primary sources of data showing the relative distribution of trips within the Downtown Area are the Maguire and Coverdale and Colpitts Studies of 1945 and 1957. These distributions have been utilized by the parking study conducted by the City Planning Board in 1954 and have been utilized here to allocate the person-trips to the various functional areas in the Central Business District. The area of the CBD referred to in this section is larger than the project area now under study. In addition to the CBD Project Area, this area contains the State House Area, all of the office districts, all of the leather-wholesaling district, and part of the South Cove Area. It is more nearly analogous to the Downtown Central Area.

The estimated number of person-trips per day made to this area in 1963 by mode of transportation is motor vehicles (excluding trucks), 135,000, and mass transportation, 130,000.

The amount of future travel in the Central Business District depends entirely on the growth in floor space and employment within the CBD. For purposes of preliminary calculations, it has been assumed that total travel will increase from 12 to 20 percent and that mode of travel will increase accordingly: motor vehicles (excluding trucks), 155,000-165,000 trips, and mass transportation, 145,000-155,000 trips.

DISTRIBUTION OF TRIP DESTINATIONS WITHIN THE CBD PROJECT AREA

The distribution of person-trips within the CBD[2] is described below. The estimates are based upon data incorporated in the off-street parking study of the Boston City Planning Board (1954), the reports dealing with origins and destinations referred to above, and estimates of the travel generating characteristics of land-uses within the CBD. For each of the subzones of the CBD the total number of person-trips, existing and future, are given in Tables 23 and 24. Figure 17 illustrates the location of these subzones and the person-trips destined to each. These values are considered as preliminary estimates. They will be refined and modified to relate to the CBD project boundaries as soon as data on current land-use within the project is made available.

The travel generating factors that have been utilized to calculate the amount of subarea person-trips per day are listed in Appendix Table 5. In all cases the data refers to the number of person-trips originating from beyond the limits of Downtown Boston and, therefore, excludes intra-Downtown trips and walking trips.

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[2]This includes trips originating from outside of the Downtown Area only and excludes truck and walking trips.

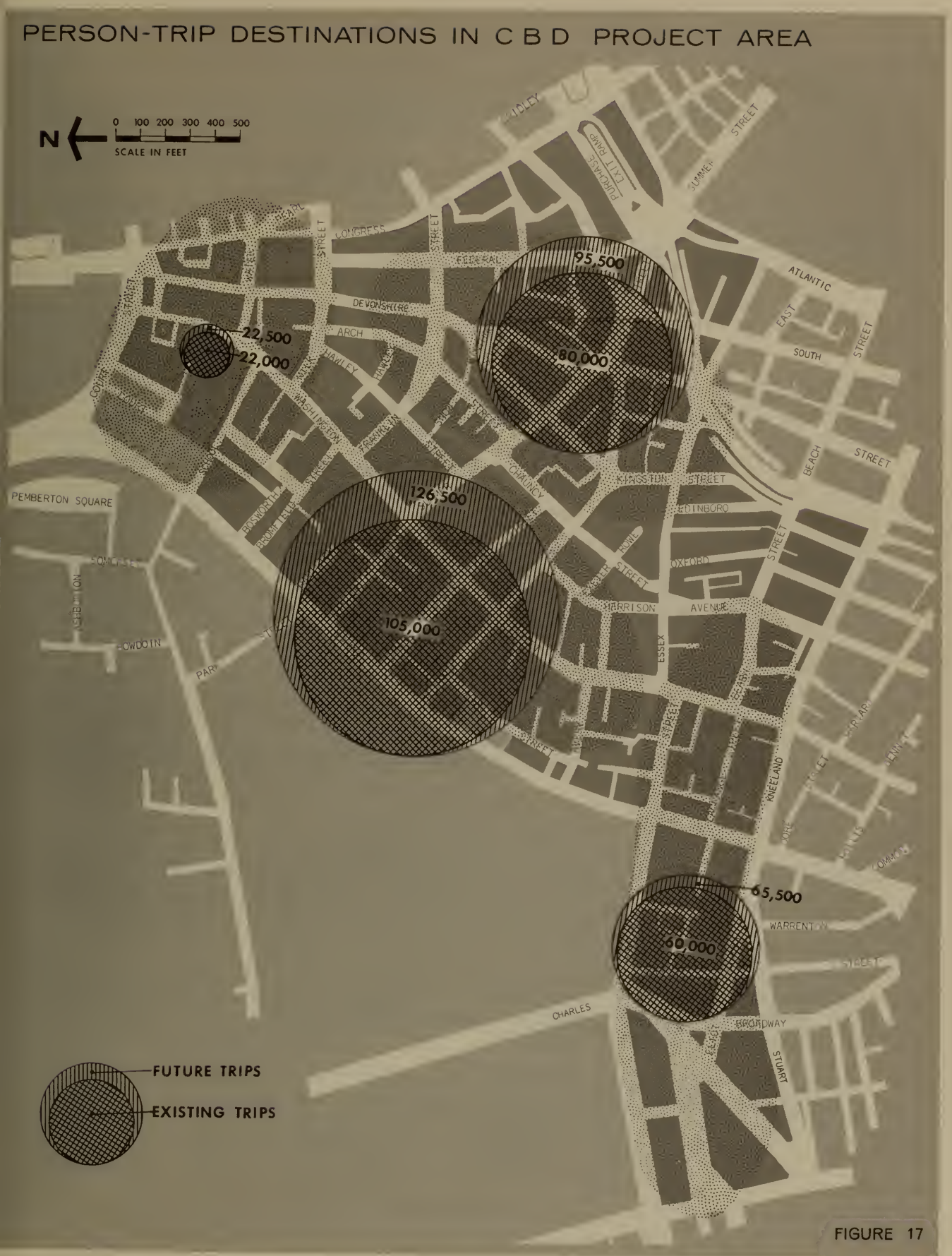

PERSON-TRIP DESTINATIONS IN C B D PROJECT AREA
N
0 100 200 300 400 500
SCALE IN FEET
95,500
80,000
22,500
22,000
126,500
105,000
65,500
60,000
FUTURE TRIPS
EXISTING TRIPS
PEMBERTON SQUARE
DEVONSHIRE
ARCH
FEDERAL
CONGRESS
STREET
ATLANTIC
EAST
SOUTH
BEACH
KILMARNOCK
EDINBORO
OXFORD
HARRISON
AVENUE
ESSEX
KNEELAND
WARRENTON
CHARLES
BROADWAY
STUART
PUDDING-
EXIT RAMP

FIGURE 17

Table 23
EXISTING PERSON-TRIP DESTINATIONS, CBD PROJECT AREA, 1963

Subzones	Total Person-Trips
State House Area	20,000
Office District	80,000
Retail Area	105,000
Leather, Entertainment, Park Square Area	60,000
Total:	265,000

Table 24
FUTURE PERSON-TRIP DESTINATIONS, CBD PROJECT AREA, 1980

Subzones	Total Person-Trips
State House Area	22,000- 23,000
Office District	93,000- 98,000
Retail Area	122,000-131,000
Leather, Entertainment, Park Square Area	63,000- 68,000
Total:	300,000-320,000

PROJECTED PARKING DEMAND

The existing parking situation with regard to supply and demand in the Downtown Central Area was summarized in Table 12, Chapter 2. The peak demand is 15,000 spaces within the DCA and 18,000 spaces when the fringe area is included.

In calculating the future parking requirements for the DCA it was assumed that three types of parking would be provided: long-term off-street, short-term off-street, and errand off-street. All curb parking is expected to be removed from DCA streets. It also is assumed that estimated future parking demand can be predicated on the 12-20 percent increase in current demand resulting from new development in the area.

Conversion of the existing parking (legal curb, illegal curb, double, and fringe) to long-term, short-term, and errand parking yields the following summary of current demand:

Long-term Off-street -	11,100
Short-term Off-street -	4,700
Errand -	2,200
Total:	18,000

Expansion of this demand by 12-20 percent yields future demand:

Long-term	12,400-13,300
Short-term	5,300- 5,600
Errand	2,500- 2,600
Totals:	20,200-21,500

Adding 15 percent to short-term and errand demand to permit free circulation and turnover of vehicles yields the following adjusted figures:

Long-term	12,400-13,300
Short-term	6,100- 6,400
Errand	2,900- 3,000
Totals:	21,400-22,700

As a result, the estimated future peak parking demand for the DCA is expected to range between 21,000 and 23,000 spaces. These figures are consistent with expected vehicle travel to the DCA.

SUMMARY

It is estimated that the number of people who travel to Downtown Boston during an average day is about 385,000. This figure does not include walking trips, trips *through* the downtown area, or those trips generally contained entirely within the area. The amount of future travel to the Downtown Area can be expected to increase in proportion to the amount of additional development occurring within the area. Other studies have indicated a potential growth of from 12 to 20 percent in the entire Downtown Area by 1980. Such growth would attract an additional 50,000 to 80,000 persons to the Downtown Area each day, with total average travel approximating 462,000 person-trips per day.

Of the existing 385,000 person-trips per day made to the entire Downtown Area, it is estimated that about 265,000 of these trips are destined to the Central Business District. By 1980, this figure should increase to between 300,000 and 320,000 person-trips per day. Figure 18 illustrates the existing person-trips to and through Downtown Boston by mode and also indicates those trips destined to the CBD. The future number of person-trips to the downtown and CBD is also shown.

The existing modal split of trips destined for the Central Business District is 135,000 motor vehicle trips and 130,000 transit trips. The anticipated future modal split is 155,000-165,000 vehicle trips and 145,000-155,000 transit trips.

Studies also indicate that there is a significant amount of through traffic in the core area amounting to 30 to 40 percent of the total traffic flow. Further, an additional 20 to 25 percent of traffic on any given street is likely to be using an indirect route or traveling in a direction contrary to the desired direction.

PERSON-TRIPS TO AND THROUGH DOWNTOWN BOSTON

FIGURE 18

Regarding parking, the present capacity is approximately 13,000 vehicles to be parked at a given time; however, studies show an existing demand for nearly 15,000 parking spaces. When projected to reflect future growth, a parking demand of about 22,000 vehicles is expected to occur.

4
THE GENERAL ACCESS AND CIRCULATION PLAN

DEVELOPING an access and circulation plan to serve the Boston Central Business District involves consideration of the many factors that influence the extent, type, and quality of the street network to be provided. As background, then, all facets of the metropolitan transportation system must be identified, and their effect upon the CBD street network must be estimated. The preceding chapters of this report established these elements and offered a realistic appraisal of them.

Detailed specifications for the *vehicular* access, circulation, and parking plan are presented in this chapter. The text is composed of three sections. The first presents principles intended to serve as a guide for the development of the *general* circulation plan. This is followed by a discussion of the *vehicular* circulation plan concept. The final sections of the chapter describe the recommended improvements and additions to the street network required to implement the plan concept and recommendations for parking facilities.

Specific, detailed plans for other elements of the total transportation system (transit, pedestrian circulation, etc.) are beyond the scope of this study and have been the responsibility of other participants in the Central Business District Planning Program. However, all facets of the metropolitan transportation network are an integral part of the comprehensive circulation system and have been carefully considered here in the formulation of the *vehicular* circulation concept.

PRINCIPLES GOVERNING CIRCULATION PLANNING

The following principles are intended to help guide the development of a general plan for the Boston Downtown. They apply to all phases of downtown circulation, including public transportation, vehicular circulation, parking, pedestrian circulation, service and emergency vehicle facilities, and several general conditions.

Transit Principles

1. Maximum use should be made of public transit facilities serving the Downtown Boston Area. This involves taking a positive approach to

transit improvements, not only in regard to the Downtown Area, but including such aspects as route extension and other outlying improvements.

2. From the standpoint of downtown development, the most important transit patrons are those people employed in the Downtown Area. Maximum use of transit by employees will reduce peak-hour vehicle volumes most effectively.

3. Use of rapid transit should be emphasized as the most effective and efficient form of public transportation.

4. Nevertheless, surface transit (buses) should not be neglected as a means of adding to the total public transportation capabilities available to serve the CBD.

5. Priority in the use of street facilities should be given to the transit vehicles, especially surface transit. This may mean special transit lanes, transit malls, and terminals.

6. To the extent possible, commuter transit facilities should serve as their own Central Business District distributors, thereby eliminating transfers to other transit vehicles or changes in transportation mode.

7. Maximum use of transit for short trips between points *within* the CBD (or for trips made between points adjacent to the area that must move through it) should be encouraged and stimulated. This would minimize use of the private passenger vehicle for such short, cross-area trips. However, some special, secondary type of transit should be provided for these trips in order to reserve the primary transit system for long-haul commuters.

8. To the extent possible, the principle of *through-routing* should be applied to all transit facilities entering the CBD to avoid the looping and artificial doubling of routes that are required where transit lines terminate within the CBD. This involves establishing continuity of routes through the area for rapid transit facilities and surface bus lines.

9. Land-uses should be so located to capitalize on and stimulate maximum use of transit facilities. Similarly, transit should be located to serve land-use most advantageously.

Vehicular Circulation Principles

1. The primary purpose of streets in the Central Business District should be to provide access to the area and serve short trips across the area.

The use of CBD streets for through traffic should be discouraged. First, adequate bypass facilities should be provided to attract through

traffic away from the CBD and, second, measures should be taken to discourage that through traffic which does enter the Central Business District.

2. The circulation system should connect with existing and proposed major thoroughfares outside the area.

3. Streets should have continuity of capacity.

4. The street system should be designed to handle peak-hour traffic loads for a period of 20 years into the future. Street designs should be based on practical capacity (from 350 to 400 vehicles per lane, per hour, in the core area and 600 or more vehicles per lane, per hour, on approach routes).

5. The vehicular circulation pattern should be comprehensible to the average driver.

6. The system should be flexible; i.e., it should present more than one opportunity to reach a given destination.

7. The circulation pattern should provide direct access so as not to compel needless travel.

8. Vehicles should be able to circulate around those blocks or areas which generate high traffic volumes.

9. In establishing one-way and two-way streets, a reasonably consistent pattern of operation should be maintained.

10. The circulation system should be designed so as to minimize turning movements.

11. Ideally, given streets should perform specific functions (for example, approach routes, local access streets, cross-area streets, etc.) to the extent that a hierarchy can be identified. This should be done through the use of street design techniques, traffic control measures, parking regulations, etc.

12. Different types of traffic should be separated by combinations of either horizontal or vertical dispersal systems. For example, pedestrians and public carriers, private passenger vehicles, and service vehicles all should be physically separated.

13. To maintain safe and convenient pedestrian crossings, streets should have no more than four moving lanes, unless medians with suitable pedestrian refuges are provided.

14. In the design of the street system it should be assumed that no parking will be permitted on major elements. Nevertheless, it must be

recognized that unless land-uses are significantly reorganized, it is inevitable that the curb lanes will be used for stopped vehicles and cannot, therefore, carry significant amounts of moving traffic.

15. Complex intersections and multi-phase signals should be avoided.

16. Streets and land development should be designed to avoid conflicts and to complement each other. Land parcels should not be so large as to make circulation difficult; the street pattern should not cut land areas into parcels too small to permit sound development.

17. Special vehicle traffic generators (such as parking facilities, hotels, medical arts buildings, etc.) should be located where they may be served most effectively by the street system.

18. To the extent possible, multiple use should be made of street areas through the use of air rights and easements.

19. The distinct character of Boston and its typical street rights-of-way should be recognized and reflected in the circulation system wherever possible.

Parking Principles

Parking facilities should be designed to serve clearly identifiable classes of users as follows.

Long-term or all-day employee parking (for those employees who use cars for commuter purposes only):

1. Although the demand for this type of parking usually is large, it is in direct competition with public transportation and should receive the least consideration of all types of parking.

2. Parking for this type of user should be located at the periphery of the area on other than prime lands.

3. All-day commuter type parking should be concentrated in large facilities with the size of facilities controlled essentially by the availability of land and the effectiveness of the vehicular access which can be provided to them.

4. Such parking facilities should be located in direct contact with major vehicular entry points.

5. Facilities should be distributed principally in accord with the direction of vehicular approach to the area.

6. Employee parking should be self-supporting but, because of its location on other than prime lands, relatively low in cost.

Employee parking for executives and others requiring midday use of cars.

1. Such facilities should be extremely convenient, even to the extent of being located within buildings which generate or require their use.

2. This type of parking should be limited in quantity.

3. Parking fees (or leasing charges) should be sufficient to meet the relatively high cost of providing such convenient parking.

Parking for patrons of downtown retail, office, and services facilities is essential to the economic success of the area.

1. These facilities should be conveniently located in relation to the downtown area they serve.

2. Parking units should be moderate in size and related to vehicular access capacity.

3. Fees should be low with consideration given to possible subsidization.

4. Patron facilities should be regulated to control length of parking, especially through the use of the parking rate structure.

Errand parking or high-turnover facilities (especially to replace curb parking spaces).

1. Facilities should be widely distributed throughout the area.

2. Parking units should be small in size.

3. The rate structure should rigidly control the duration of stay.

In general, on-street parking should not be permitted and curb space should be reserved for stopped rather than parked vehicles. To the extent possible, all facilities should be designed to operate on a self-parking basis. Entrances and exits to parking facilities should be located on one-way streets or *astride* two-way streets in order to minimize left-turn conflicts into and out of facilities. Parking facilities, as a type of land-use, should not conflict with the general continuity of other land-use patterns or with pedestrian flow patterns. Pedestrian movement patterns should be considered in locating parking facilities. Wherever possible, the parking plan should facilitate dual use of facilities (for instance, daytime employee and nighttime recreational parking).

Pedestrian Circulation Principles

1. Walking should be made feasible and desirable by placing related land-uses in proximity to one another.

2. A suitable environment for pedestrians should be established. This should include, in addition to other amenities, protection from weather.

3. Just as there should be continuity in the *plan* of pedestrian circulation, there should be a continuity of *elevation*. For example, concentrations of pedestrians alighting from subway trains should be reconciled with possible second level pedestrianways and bridges.

4. Pedestrian-vehicle conflicts should be minimized by design techniques. For example, these conflicts are most serious at intersections where turning movements as well as through traffic complicate pedestrian crossings. Proper design of both streets and land-use can reduce this problem.

5. Although the general dimensions of the CBD make the need for mechanical pedestrian conveyances questionable, if such devices are used, they should serve a true distributive function. In other words, such devices are self-defeating if they involve *stations* rather than virtually continuous access to adjacent land-use.

Principles for Circulation of Service and Emergency Vehicles

1. Emergency vehicles *must* be able to reach any portion of the area in a reasonably direct manner.

2. Facilities must be provided to accommodate the needs of regular merchandise vehicles, quick-stop service (such as mail and newspaper trucks), and special purpose vehicles such as construction and maintenance trucks.

3. Two kinds of service facilities are required. The first, and most appropriate type for the core area, would be communal facilities such as special service courts, tunnels, conveyor systems, etc. Other buildings within the general area may require individual on- or off-street loading areas.

General Principles

1. All elements of the circulation plan should be practical and attainable.

2. In general, the circulation plan should be capable of being completed within five years.

3. The circulation plan must be designed for implementation in stages with individual elements available for use as they are completed.

4. While in terms of traffic capacities, the design year is 1985, the plan generally should be useful over the next 40 to 50 years.

VEHICULAR ACCESS AND CIRCULATION CONCEPT

The principles set forth in the preceding section of this chapter established the guidelines within which the vehicular circulation plan has been conceived. The basic objective of the plan is orderly, convenient, and efficient traffic movement to, within, and from the Central Business District. As such, the plan concept must recognize these characteristics:

1. Ability to accept the inbound traffic volumes from the regional roadnet surrounding the CBD.

2. Provide access to CBD destinations for these volumes.

3. Offer the opportunity to recirculate within the area.

4. Provide terminal facilities conveniently located with respect to destinations.

5. Facilitate egress from the CBD.

6. Discharge traffic volumes back onto the regional roadnet for the return trip to place of origin.

In addition to these internal attributes, the system must have a logical coordination with the main arterials and expressways serving the rest of Downtown Boston. At the same time it must be related to an entire system which provides attractive bypass facilities to discourage through traffic (traffic not having a destination in the CBD) from entering the CBD.

CBD-Related Traffic Movements

For the purposes of developing a circulation plan, the flow of traffic converging on the CBD must be considered. The magnitude and direction of approach of this traffic is established by the heavily traveled routes which funnel traffic into Downtown Boston from East Boston, South Boston, Roxbury, Back Bay, Cambridge, Charlestown, and the suburbs beyond.

The major portion enters Downtown Boston and either is directed immediately to the CBD along the extension of the arterial route on which it entered Downtown Boston, or it is directed onto the circumferential streets and expressway facilities along the periphery of the Downtown Area. At this point traffic is presented with the alternatives of bypassing the CBD or entering a lower-speed distribution system that will direct it to a CBD destination.

This lower speed distribution system consists in essence of arterial routes and distributor-collector streets which ideally should provide an acceptable level of service to the CBD-destined auto.

However, the problem in Boston (and other cities of comparable size) is assuring continued mobility on this adjacent distribution system, so as not to discourage the driver destined for the CBD before he has the opportunity of reaching his destination.

This orients the problem toward the CBD itself, for if it does not possess the innate ability to circulate traffic bound for its various elements, or if it does not have the terminal facilities to accommodate the accumulation of parkers, congestion results and the backlog is disseminated to all parts of the distribution system.

As the CBD is the focal point of the commercial activities of the urbanized area, a vehicle circulation plan must cater to the specific land-uses there which generate the traffic. It must give traffic from north, south, east, and west access to a host of activities and pursuits. It should not be a dominant or major traffic system; its only role is to serve the established or planned development, and in that capacity it must be proficient.

Specifically, the Boston circulation system has the task of serving a comprehensive CBD renewal project. The hub of this project is the retail core which is being transformed into a 1,800-foot pedestrian mall. The crescent-shaped locus of activities surrounding this mall embraces the Upper Washington, Financial, Church Green, Garment-Leather, Entertainment, and Park Square districts.

In the process of establishing a circulation concept, it is apparent that Boston Common, which borders the retail core on the northwest, is a distinct topographical advantage. This immediately excludes a direct, heavy influx of traffic from the northwest, diverting it to either a north or southwest entry point and eliminating many cross conflicts that might result if heavy penetration to the core were possible from this direction.

Primary Corridor Network

With traffic thus channelized by this natural barrier, further examination of the existing street network suggests methods of promoting mobility around its extremities. Through some major alterations of offset and multi-leg intersections and the subsequent linking of some random, multi-use streets, both north-south and east-west travel can be made to proceed along continuous roadways. So altered, the CBD would adapt itself readily to a system of longitudinal and transverse corridors.

These corridors would offer through, continuous travel across the expanse of the CBD while affording access to all land-uses and activities. Each corridor would consist of two closely associated parallel, one-way routes handling traffic movements in opposite directions, thereby employing the advantages of the one-way pair.

A series of three of these corridors would move traffic in a north-south direction, while three more corridors would complement the network by handling the east-west flow.

With modification of the existing CBD street system (indicated later), the three north-south corridors can be made to run essentially parallel to the longitudinal axis of the mall and the three east-west corridors perpendicular to it. These corridors are defined as follows (see Figure 19):

The North-South Corridors:

1. Tremont paired with Chauncy-Arch.

2. Devonshire-Otis-Kingston paired with Lincoln-High-Federal-Congress.

3. Purchase-South paired with Atlantic and connected to the under-artery street system.

The East-West Corridors:

1. School-Milk paired with Bromfield-Franklin.

2. Boylston-Essex paired with Essex-New Street (Essex two-way in part).

3. Stuart-Kneeland--St. James system.

These major corridors would function as the primary circulation routes. However, the layout of these corridors reveals two obvious voids in the pattern they form.

The first void is caused by the two-block distance between the Tremont and Chauncy-Arch couple as it skirts the perimeter of the Washington Street Mall. This gap is closed at the north end by the convergence of Washington and Chauncy-Arch, but it remains at the southern edge. Washington Street, formerly an important route through the core, can be used as a two-way penetrator route, forming a "T" intersection with New Street at the southern edge of the Mall.

The second void in the corridor pattern results from the fact that east-west routes must funnel traffic around the northern and southern edges of the Mall and Common. In order to provide direct access to the retail area for traffic from points south and southeast, Summer Street would have to be converted to a strong two-way penetrator route to Chauncy-Arch.

In addition to affording direct access to the primary "around-the Mall" circulation, these penetrators each intercept two, one-way corridors. This adds increased flexibility to the circulation system and enhances the prospects of recirculation. Also, more CBD activities are given frontage on the major street system.

VEHICULAR CIRCULATION CONCEPT FOR THE C B D

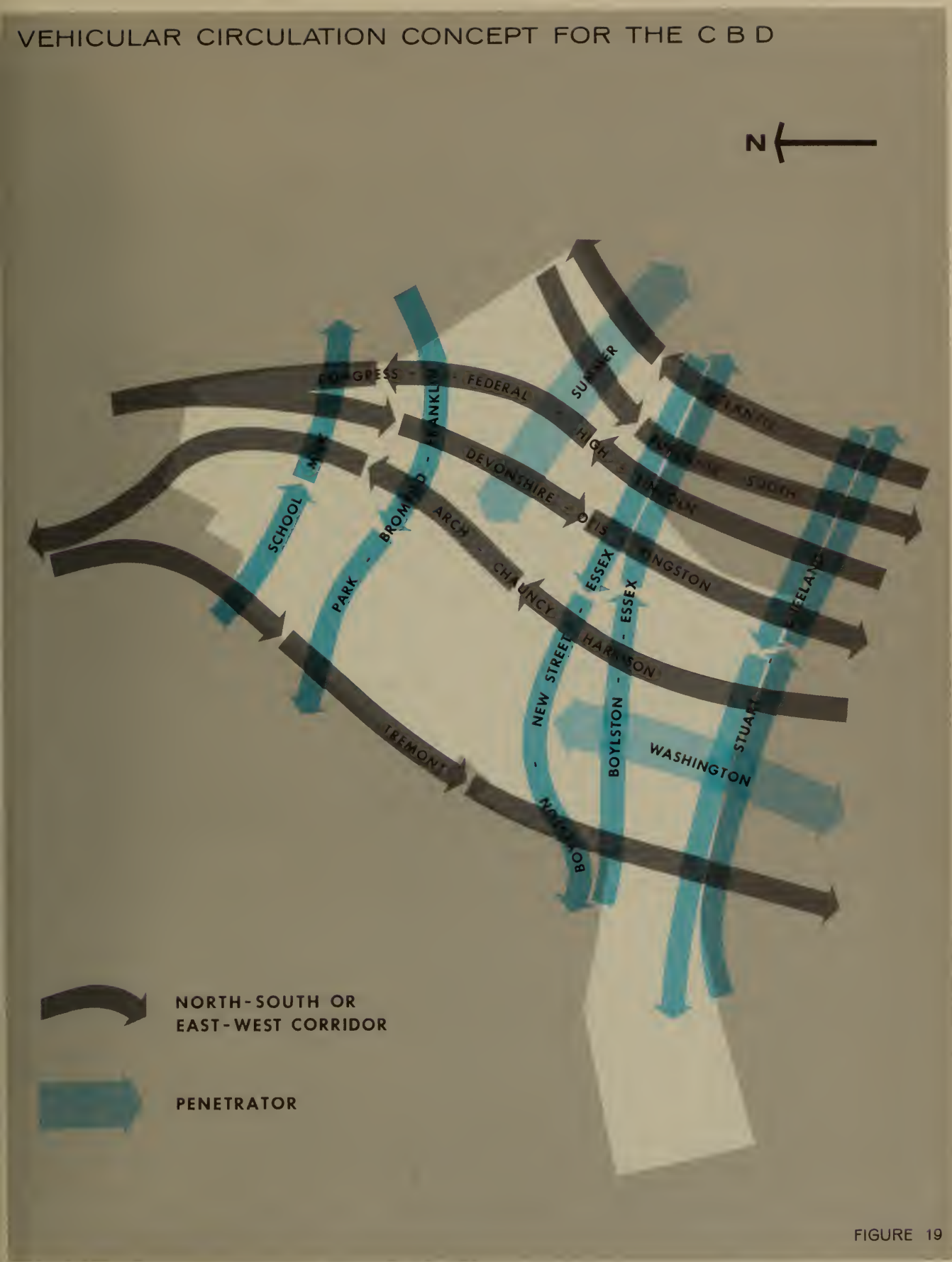


FIGURE 19

This primary corridor network, interlaced with penetrator routes, provides directional mobility to any vehicle, regardless of point of entry into the CBD. However, it does not preclude the need for a subordinate network of strategically located service routes to transport freight to loading or unloading points. In the past, the mixing of this service traffic with passenger traffic has been a major factor contributing to Boston CBD congestion. Fortunately, the random pattern of the earlier Boston network will be of great benefit in the formation of a service street system if adequate access to the major corridor-penetrator roadnet can be attained. Augmenting this system with three planned service tunnels will further separate truck and auto traffic circulation.

The prospects for an effective vehicular circulation plan are heightened by proposed highway improvements, improvements in transit, the addition of off-street parking, elimination of curb parking, and increased separation of pedestrian-vehicular and truck-auto circulation. An adequate signalization system is a prerequisite to preserving continuity of efficient traffic movement in the corridors.

In general, this conceptual plan provides greater continuity in a north-south direction; virtually eliminates intersection offsets, while striving for better alignment and continuity of capacity; provides east-west, one-way couples; and includes the complete redesign of major problem areas, such as the multi-leg intersections of Dewey Square and Park Square. Adequate connections to street systems in adjacent areas have been considered in the light of continuity of movement and the compatibility of adjacent systems as parts of a total transportation network for Downtown Boston, shown in Figure 20.

FUNCTIONAL STREET ELEMENTS OF THE PLAN

The basic objective of a vehicular circulation plan is to provide access to the land-uses in the area and adequate circulation among these uses. Prior to the preliminary steps in designing a vehicle circulation plan, considerable thought had been given to development of basic land-use concepts, including a discussion of land clearance and acquisition estimates. Quite early in the initial planning of the circulation system it became apparent that construction of a new street system, such as was developed for Government Center, was not practical. Necessity dictated that the circulation system be implemented by major improvements to the existing CBD street system.

An examination of the existing pattern offered some immediate suggestions as to how the existing bottlenecks might be alleviated through better alignment and continuity of width and capacity. The realization that such changes could be effected played an important part in formulating the system of one-way corridors previously described. This system is based on a series of selected width changes, intersection and roadway realignments or redesigns, and the establishment of adequate connections to the surrounding street and highway network.

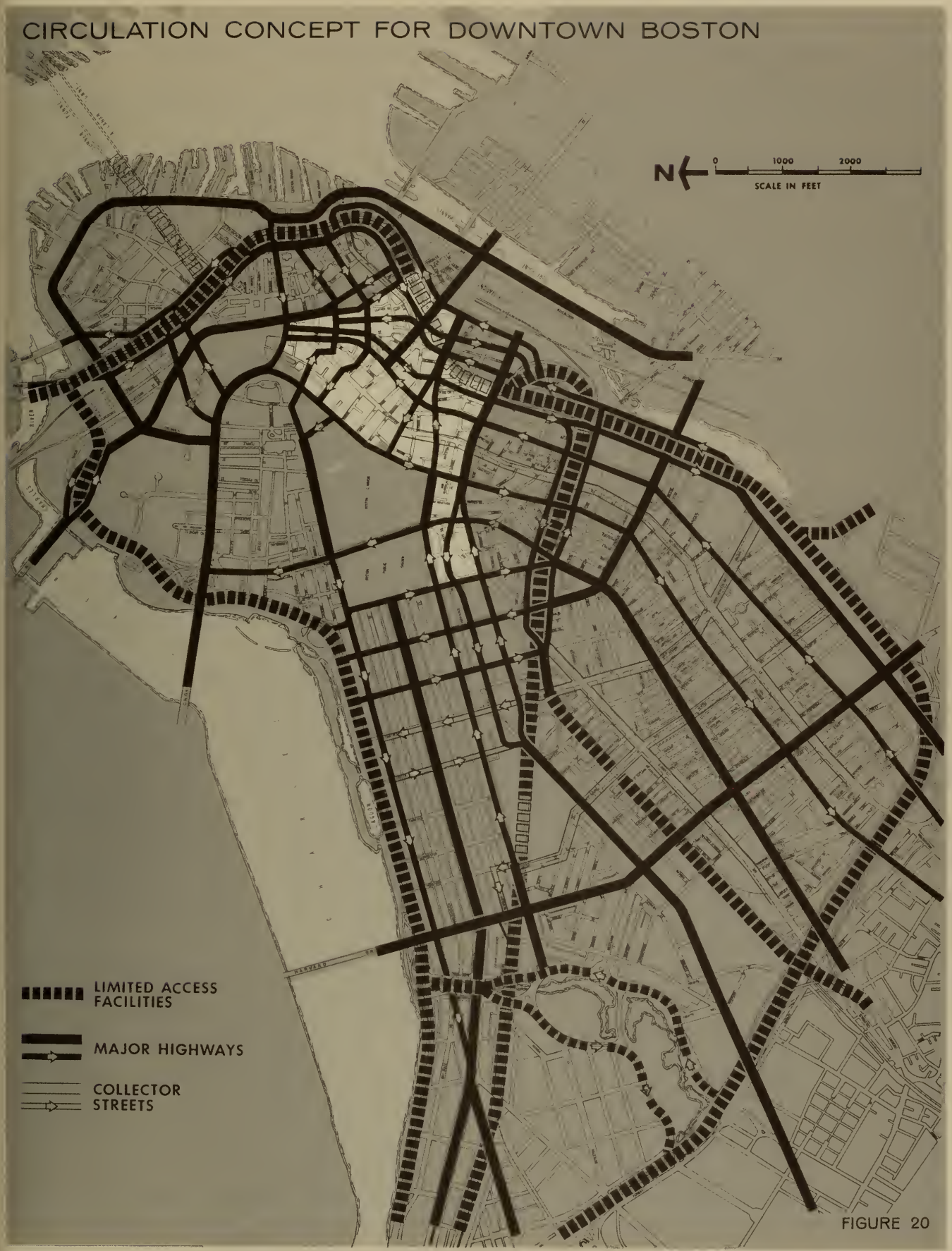

CIRCULATION CONCEPT FOR DOWNTOWN BOSTON
N
0
1000
2000
SCALE IN FEET
LIMITED ACCESS FACILITIES
MAJOR HIGHWAYS
COLLECTOR STREETS

FIGURE 20

For purposes of clarity, the street elements of the circulation system are broken down by north-south and east-west streets. Within the north-south group, the system is described starting with Tremont Street and moving east toward Dorchester Avenue; similarly within the east-west group the system is described starting with Court Street, moving generally south and west toward the Park Square Area. The proposed street system is as shown in Figure 21.

While more extensive treatment may be given to some of the one-way corridor streets, no hierarchy of priorities is intended. The minor streets generally have been disregarded except where their present operation has been altered somewhat by the new plan. The Central Artery crosses the eastern portion of the CBD study area, but since it is grade-separated from the other streets, its effect is considered only insofar as ramp connections might influence the circulation pattern. Parts of the Surface Artery, which formerly was a high-capacity frontage road paralleling the Central Artery, will be eliminated as a through-traffic carrier by the proposed street revisions.

Preliminary geometrics and operational aspects of the functional street elements of the Proposed Vehicular Circulation Plan are shown in Figure 26, enclosed in the pocket at the end of this report.

The North-South System

Tremont Street. Tremont Street is 44 feet wide and one-way southbound. It is proposed that Tremont Street remain as it is, except for widening to 55 feet for a distance of about 200 feet north of Boylston Street. This proposed widening is dependent upon the physical possibility of widening between the existing westerly curb line and the subway kiosk. The purpose is to provide an extra lane for the extremely heavy right-turn movements at this location.

Washington Street. Widening of Washington Street to an 85-foot right-of-way from Kneeland Street to Essex Street is proposed. This section of Washington would have a pavement width of 55 feet. North of Essex a 44-foot roadway should be carried to a point somewhat north of Norfolk Place at the intersection of a proposed new east-west street. This entire section of Washington Street would operate two-way, matching the two-way operation in South Cove.

Harrison-Chauncy-Arch Streets. It is proposed that Harrison Avenue be widened to a 44-foot roadway from Kneeland Street, where it connects to South Cove, to Essex Street, where it connects to Chauncy Street. A 68-foot right-of-way is proposed for Chauncy Street, with a 44-foot roadway carried through Summer Street, where an improved connection with Arch Street can be accomplished by taking the northwest corner. The 44-foot roadway is then carried to Milk Street and connected to a widened Washington Street approximately in the vicinity of Water Street. It is proposed that this newly developed thoroughfare be operated one-way northbound as a companion street to southbound Tremont Street.


PROPOSED C B D STREET SYSTEM
N
0 100 200 300 400 500
SCALE IN FEET
GRIDLEY
EXIT RAMP
FEDERAL
DEVONSHIRE
WASHINGTON
HAWLEY
SUMMER
KINGSTON
LINCOLN
ATLANTIC
SOUTH
BEACH
EDINBORO
OXFORD
HARRISON
AVENUE
PEMBERTON SQUARE
BOWDOIN
PARK
TEMPLE
PLACE
AVON
CHARLES
CARVER
BROADWAY
ELIOT
STUART
WARRENTON
KNEELAND
MAJOR STREET
SECONDARY STREET

FIGURE 21

The purpose of this 44-foot roadway is to replace Washington Street and provide the additional traffic capacity needed through the CBD. New development fronting on this street will generate considerable pedestrian activity. A minimum sidewalk width of 12 feet is recommended, with additional setbacks or arcades wherever possible.

Kingston-Otis-Devonshire Streets. The proposed plan calls for a continuous roadway to be carried from State Street along Devonshire to Otis Street at Winthrop Square; then to a widened Kingston Street past Essex Street, over the expressway exit ramp to Kneeland Street via a new roadway replacing the Surface Artery, and connecting to the ramp leading southbound on the Expressway and Albany Street, and westbound on the Turnpike.

It is proposed that this street have a 33-foot roadway wherever possible. Devonshire Street can be widened to 33 feet between State and Water Streets, and to 32 feet between Water and Milk Streets, by virtually eliminating the sidewalks. Pedestrian frontage can be provided on other streets with slight alteration of the buildings. (These changes must naturally precede the street widening.)

The improved street would operate one-way, southbound, paired with Lincoln-High-Federal Streets. Its function is to carry traffic from State and Congress Streets, south to east-west connections and the access to the expressway network. It is recommended that this street be developed as a major traffic carrier with a minimum of pedestrian attractions.

Lincoln-High-Federal Streets. The plan calls for this street to carry vehicles from Kneeland Street and a connection with off-ramps from the expressway network to Essex Street, then diagonally along a new 33-foot roadway to High Street at Summer Street, around an improved corner at High and Federal Streets, thence along Federal to Milk Street. At this point, a right-turn will take vehicles into the Financial District and to Congress Street at Post Office Square, providing a route for those desiring to continue northbound. The street is planned to operate one-way northbound, paired with Devonshire-Otis-Kingston Streets.

The resulting intersection of Federal and Milk Streets is not a desirable situation. A direct connection between Federal and Congress Streets appears to be economically unfeasible and no other solution has been found. Every effort should be made to find a feasible way of making this connection in the future.

The intersection of High and Federal Streets should be designed so as to encourage vehicles to continue along the High-Federal Street alignment. This becomes increasingly important in the light of an anticipated convergence of three one-way legs at the corner of Pearl and High Streets. Encouraging drivers to move along the High-Federal alignment can be accomplished by some combination of painted lines, channelization, and signing.

Purchase-South Streets. Purchase Street is planned to operate one-way southbound to a connection with a new 33-foot street between relocated Summer Street and widened Essex Street, connecting in turn to South Street. Paired with Atlantic Avenue, this street functions as a bypass relief street, as an access street to the under-artery roadway, and as a distributor for Congress and Essex Streets.

Atlantic Avenue. Atlantic Avenue is proposed to operate as the northbound one-way portion of the Purchase Street-South Street pair. The plan proposes that Atlantic Avenue be improved to a 55-foot roadway from Kneeland to Summer Street, and 50 feet from Summer to Congress Street where it connects to existing Atlantic Avenue.

Dorchester-Atlantic Avenue Connection. This proposal requires that a new roadway be built connecting Dorchester and Atlantic Avenues from the South Bay area to the Northern Avenue Bridge area. This connection, which will serve the north and southbound traffic on the eastern edge of the CBD, will be constructed along the west side of Fort Point Channel and would be part of a proposed six-lane, divided arterial paralleling the Southeast Expressway and the Central Artery. Most of this proposed roadway will be outside the CBD Project Area, but the portion within the project--from South Bay to Summer Street--is a vital link.

The East-West System

Court Street. The plan calls for Court Street to be widened to 44 feet from Washington Street to Court Square and beyond to Cambridge Street. Court Street would operate one-way, westbound. (The design of the Washington-Court Streets intersection is suggested so as to relate to possible future two-way operation along a widened State Street east of Congress Street.)

State Street. No changes are proposed for State Street other than a 33-foot roadway between the Old State House and the Parcel 8 Tower in Government Center.

Water Street. It is recommended that Water Street remain open from Chauncy-Arch Streets to Congress Street, operating as an eastbound, one-way connector.

School-Milk Streets. School Street is another street that should be widened except where it appears to be economically unfeasible to do so. However, if on-street parking can be prohibited, it should be able to carry two lanes of traffic. Every effort should be made to take advantage of any opportunities which may arise in the future to widen this street to a 33-foot roadway.

The connection from School to Milk Street is made somewhat awkward by the presence of the Old South Meeting House, but the smooth flow of traffic on this 33-foot roadway across the Mall would be aided by the early acquisition of the southwest corner of School and Washington Streets

and a slight adjustment of the curb line at the northeast corner of Milk and Washington Streets.

School-Milk would operate one-way, eastbound. It would function as the eastbound companion for both State-Court Streets and Franklin-Bromfield Streets. It also would provide vehicular access from the Beacon Hill area to the CBD, the Financial District, and the Waterfront.

Franklin-Bromfield Streets. This street system would operate essentially one-way toward Tremont Street. Franklin Street can be widened to 33 feet from Devonshire Street to Washington Street, and Bromfield Street can be similarly widened from Washington Street to Province Street. The desirability of widening Bromfield all the way to Tremont cannot be overemphasized, and it is urged that ways to accomplish this widening be pursued. Until Bromfield can be widened, servicing should be rearranged in this block so that parking can be prohibited, thus allowing two lanes to operate.

For purposes of recirculation, Franklin Street should be operated as a two-way street from Chauncy-Arch Streets to the east. Such widening as may be possible should be undertaken to accomplish this.

Summer-Winter Streets. Winter Street will be closed to vehicular traffic and used exclusively by pedestrians. Summer Street also will be closed and converted to pedestrian use from Washington to Chauncy Street.

From Chauncy Street to Dorchester Avenue, Summer Street is to be widened, realigned, and redesigned to operate as a major two-way street. From Chauncy Street to High Street, Summer Street would be widened to 60 feet. From High Street to Atlantic Avenue, Summer Street would be widened to 72 feet, including a six-foot median, and relocated somewhat to the south of the existing street. Both the street width and the alignment are proposed to be carried across the front of present South Station, meeting the existing or a new bridge across the Fort Point Channel at the intersection with existing or relocated Dorchester Avenue. This realignment, coupled with the north-south movements discussed above, will eliminate the vehicular and pedestrian hazard and confusion at Dewey Square.

The variation in width along Summer Street, or, specifically, the constriction between Chauncy and High Streets, represents a compromise with land planners who desire to obtain maximum footage for prime development parcels.

Since the planned development along Summer Street is intended to generate a great deal of pedestrian activity, a sidewalk width of 15 feet is recommended throughout this improvement.

The new Summer Street is proposed as a major distributor from the east into the main retail area of the CBD. It also is the focus for major expansion and consolidation of the retail core. The proposed widen-

ing and realignment which eliminates Dewey Square and the Surface Artery provides a much better operational configuration which can be comprehended more easily by shoppers and visitors.

Temple Place-Avon Street. Temple Place would be closed to vehicular traffic. Provision for servicing land-uses fronting on this street via a service tunnel are proposed.

Avon Street will remain open as a 22-foot street dead-ending into the Mall. The ultimate disposition of this street depends on the development of the properties on each side.

West-Bedford Streets. West Street is proposed to remain one-way, eastbound, as part of the local circulation pattern. If major land-use changes take place on either side of this street, the need for additional widening should be considered in the light of the proposals made at that time.

Bedford Street is proposed to be widened, providing a 33-foot street operating one-way from Washington Street to Kingston Street. A connection would be maintained with Columbia Street, but Bedford would be discontinued from Columbia to Lincoln and Summer Streets.

Avery Street-Hayward Place. Avery Street would operate one-way, eastbound, while no change is proposed for Hayward Place. Though minor streets, these are considered part of the local access and circulation system.

Boylston-Essex Streets. Boylston Street would remain physically and operationally as it is from Arlington Street to Tremont Street. From Tremont to Washington Streets, Boylston would remain one-way, eastbound, and widened to 33 feet with a new alignment to eliminate the jog with Essex Street. The roadway would curve to the north from about Burnstead Court to meet the present Essex Street alignment.

Essex Street would be widened to 33 feet and operate one-way, eastbound, from Washington to Kingston Street. Between Kingston Street and Atlantic Avenue, Essex Street would be two-way with three 11-foot lanes in each direction, separated by a medial island. This median would be two feet wide from Kingston Street to Lincoln Street and six feet wide from Lincoln Street to Atlantic Avenue. The eastbound portion of this two-way section would be a continuation of the Boylston-Essex one-way section. The westbound portion of the two-way section would continue on a proposed new alignment which is referred to here as New Street.

New Street would be a 33-foot street one-way, westbound, from Kingston Street to Tremont Street approximately along the alignment of Rowe Place and Exeter Place, across the intersection of Norfolk Place and Harrison Avenue Extension, then parallel to and just north on Mason Street, intersecting Tremont Street just south of the White Funding Building. It is expected that westbound traffic on New Street would be the return move-

ment of eastbound Boylston-Essex Street and would travel for a short distance on Tremont Street, turning right at the intersection with Boylston Street. This movement, added to what is already a heavy right-turn, increases the need for widening Tremont Street in this vicinity to provide an additional right-turn lane.

La Grange-Beach Streets. The plan proposes that La Grange Street be closed to vehicular traffic. Beach Street would remain as it is with the directional flow changed to one-way, *westbound*, instead of *eastbound* between Atlantic Avenue and Washington Street.

Kneeland Street. Kneeland Street would operate two-way from Atlantic Avenue to Washington Street. It is recommended that Kneeland Street (and its extension, Stuart Street) be widened from Tremont Street to Knapp Street, giving a total roadway width of 82 feet, thus allowing two 33-foot roadways and a 16-foot island, with a 10-foot left-turn slot in the island for eastbound left-turns into Washington Street and westbound left-turns into Tremont Street.

If and when an opportunity occurs to widen Kneeland to at least Tyler Street and, if possible, further east, such opportunity should be taken to increase the width from the present 60 feet.

Stuart-St. James (Eliot-Providence through Park Square). This one-way pair would be an extension to the west of two-way Stuart Street, which itself is the extension of Kneeland Street between Washington and Tremont. Stuart Street would remain as is and meet the alignment of the south side of Kneeland just west of Washington. An island is proposed to separate the two directions of travel, matching the island on Kneeland Street. As Stuart and St. James Streets diverge west of Tremont, the island would widen to a triangular shape. St. James Street is proposed as a 33-foot roadway approximately along the alignment of Eliot and Providence Streets to Arlington Street where it connects with the extensions of both St. James and Providence Streets for westbound flow to Berkeley.

Charles Street Extension. Technically Charles Street is a north-south route which serves both as access to Storrow Drive and to give the Park Square traffic access to the parking garage beneath the Boston Common. An extension through Park Square is proposed to unite with a similar extension through the South Cove area and an eventual linkup with Tremont Street, a main arterial through Roxbury. Southbound Tremont from the CBD would be aligned with Shawmut Avenue through the South Cove area. The extension of Charles Street would provide northbound access from the frontage roads along the Turnpike. As it divides the Public Garden and the Common, it would be the northbound pairing for both Arlington Street (west of the Public Garden) and Tremont Street (east of the Common).

The present Park Square would be closed (as would Broadway) and replaced with a 52-foot roadway extending from the intersection of Charles and Boylston Streets to the intersection of Carver and Stuart Streets,

where it would connect with the new roadway through South Cove and Tremont Street. The entire extension is proposed to run one-way, northbound. Carver Street is recommended to be closed to vehicular traffic.

The 52-foot roadway and 20-foot sidewalks proposed on each side of the extension will leave adequate room for conversion to two-way operation should circulation demands require this change.

Columbus Avenue. With Park Square revised, the one block of Columbus Avenue in the CBD area would be the major access to the Statler Hotel. Columbus Avenue would not be changed in width, but it would be channelized at both ends so as to operate one-way from St. James Street toward Arlington Street. Channelization at the intersection of Columbus, Arlington, and Stuart would simplify the intersection by turning vehicles from Columbus Avenue into Stuart Street at a right angle. Thus, vehicles westbound on St. James Street would bear left into Columbus Avenue to arrive at the present "motor entrance" of the Statler. Upon leaving, they would proceed eastbound on Stuart Street. Vehicles heading for the Statler via Stuart or Arlington Streets would turn left at Church Street, then left into Columbus Avenue to the hotel.

ALTERNATE TO THE PROPOSED CIRCULATION PLAN

A number of alternate proposals to the comprehensive CBD circulation plan have been suggested during the course of this study. These range from minor modifications suggested by various special interests to relatively major alternate schemes.

The most significant of the suggested alternatives concerned traffic operations in the vicinity of Dewey Square. The city's Traffic and Parking Department points out that the southbound Central Artery tunnel bypass route via High Street would be eliminated by the conversion of High Street to a northbound roadway linking Lincoln and Federal Streets. The importance of preserving this bypass route is highlighted by (1) the necessity for all "dangerous cargo" vehicles to avoid the tunnel and (2) present high use of the route by traffic during the P.M. rush-hour when stoppages occur along the southbound Central Artery.

The possibility of providing for alternate operations to those proposed in the plan should thus be considered. The plan as proposed has sufficient flexibility so that specific details can be worked out during implementation phases. For example, as shown in Figure 22, it might be that operational efficiency would be improved by preserving the High Street bypass through the process of making High Street two-way between Federal and Essex.

On the basis of such a revision, a "round-the-block" circulation analysis has been made as shown in Figure 23. Also as a part of the process of testing the circulation plan, traffic assignments to the network have been made. Future volumes have been developed and assigned to the network

ALTERNATE CIRCULATION IN THE VICINITY OF DEWEY SQUARE

FIGURE 22

ROUND-THE-BLOCK CIRCULATION ANALYSIS

FIGURE 23

to demonstrate its feasibility from a capacity standpoint. This assignment is shown in Figure 24.

PARKING PLAN FOR THE CBD

Developing a parking plan concept for the Boston CBD involves, primarily, determining the locations that would best satisfy the demand for various types and amounts of parking space, and then relating these locations to the access and internal circulation system. Specifically, this involves meeting the driver's demand for an accessible, conveniently located space within an acceptable walking distance of his destination. An important additional consideration is that the fulfillment of parking demands must be balanced against the consequences of creating the greater use of the private vehicle that results from provision of convenient parking. Provision of traffic and parking facilities for the private vehicle must be related to the capability of public transit.

In a city the size of Boston, it should be a foregone conclusion that virtually no curb parking space will be available in the CBD. The demand for space, therefore, must be met with off-street facilities. Ideally, this off-street space would be distributed about the CBD in accordance with the traffic generation characteristics of various land-uses. However, a paradox arises here, for as the traffic generating characteristics of a particular area increase, land values increase, land rentals increase, and it becomes economically unfeasible to use this premium land for parking. Consequently the area of greatest need becomes the least *practical* place for a parking site.

On the other hand, drivers must have adjacent terminal facilities or the economy of the retail core is jeopardized. The fringe area surrounding the core must contain enough surplus space to compensate for the core's deficiency.

Other factors which have a logical bearing on the location of parking facilities include:

Purpose of trip
Walking distances
Origins of parkers
Street-traffic pattern
Proximity to intersections
Pedestrian volumes
Topography
Multi-purpose use of parking area

Consideration of these criteria, together with the general principles regarding provision of good parking facilities in the CBD, permits the formulation of a conceptual plan for allocation of parking spaces to various areas of the CBD.


TRAFFIC ASSIGNMENT TO 1985 NETWORK
P.M. Peak Hour
N
0 100 200 300 400 500
SCALE IN FEET
(000) TOTAL TRAFFIC

FIGURE 24

As a starting point, Washington Street will be closed and function as a pedestrian mall, forming the retail core of the CBD. As such, only nominal parking will be permitted in this area.

As discussed previously, the Mall is sheltered from a direct influx of traffic from the northwest by Boston Common, so the need to intercept core-destined traffic from this direction is diminished. Conversely, 30 percent of the traffic approaching the core comes from the south, so there is a substantial need for parking facilities in this area. The major portion of core-bound traffic entering the CBD from South Boston and from exits along the southbound Central Artery arrives from the east along Summer Street and should be intercepted by parking facilities en route.

Core-bound traffic is of primary concern in planning the location of off-street facilities, but there are a host of other activities in the fringe area of the core (still within the CBD) that generate a large parking demand. For example:

1. The Entertainment and Hotel District at the southern edge of The Common, along the southern extremity of the CBD.

2. The Upper Washington Street Area, consisting of retail activities and civic and historic structures, at the northern extremity of the CBD core and strategically located between the Mall and Government Center.

3. A new major retail and commercial center in the vicinity of the intersection of Chauncy-Arch and Summer Streets, the focal point for traffic from the south and east.

The trip-generating characteristics of these areas are sufficient to warrant off-street parking facilities. The suitability of these areas as sites for parking is enhanced by the fact that they are located on major corridors directing traffic to the retail core area.

More specifically, Figure 25 presents the general plan for location of parking areas that would serve the CBD renewal and existing activities. Parking locations are suggested, along with an indication of amount of parking to be supplied and type of user to be satisfied. Significant elements of the plan include:

1. Provision of 4,585 spaces east of the Mall consisting of 2,400 new spaces and 2,185 retained spaced. This parking facility will serve the Mall area and new retail and commercial developments along Summer and Chauncy-Arch Streets with short-term spaces.

2. Provision of 2,040 spaces north of the Mall, consisting of 1,780 new spaces and 260 retained spaces. The area will have to accommodate some core-bound parkers while serving substantial retail and office facilities. This will require rate structures appropriate for both long- and short-term users.

LOCATION OF PROPOSED PARKING AREAS

FIGURE 25

3. Provision of 5,550 spaces east of the Central Artery including 5,200 new spaces in the South Station area and 350 retained spaces bordering the expressway to serve long-term needs of the CBD as well as the short-term needs associated with South Station development. Long-term parkers will be aided by either rapid transit or surface shuttle in getting to CBD destinations.

4. Provision of 3,700 spaces in the Park Square and Hinge Area will serve the concentration of entertainment and hotel-motel facilities planned for this area. In addition to 1,900 retained spaced, 1,800 new spaces (900 in the South Cove area) will be provided. The needs of this area are primarily short-term.

5. Provision of 2,935 spaces along the eastern boundary of the CBD serving the financial district and office uses. The area is generally stable and no major developments are planned. All but 450 of these are existing spaces and the major portion of this parking will be long-term.

6. In addition, the Boston Common underground garage currently housing space for 1,500 vehicles could be expanded by 1,300 spaces should the need arise for more long-term parking.

Assuming development of the proposed parking areas in the CBD and fringe areas, 21,610 spaces would be provided. This should suffice to meet the future peak parking demand for the DCA, projected to be between 21,000 and 23,000 spaces (see Chapter 4).

APPENDIX

Appendix Table 1
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT WASHINGTON STREET, A.M., 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	9	3	2	-	5	-	3	1	1	1	1	2	7	6
2	22	-	-	3	2	-	14	3	2	-	-	-	6	5
3	10	-	-	4	3	-	3	1	-	-	-	-	3	-
4	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5	2	-	-	-	-	-	1	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	1	-	-	-	-	-	-	-	-	-	-	-	-	-
8	2	-	-	1	-	-	-	-	-	-	-	-	-	-
9	3	-	-	-	-	-	-	-	-	-	-	-	-	-
10	1	-	-	-	-	-	-	-	-	-	-	-	-	-
11	15	-	-	1	1	-	9	4	1	-	2	-	4	1
12	9	-	-	4	9	-	-	-	-	-	-	-	-	-
13	24	3	1	5	-	-	12	2	1	-	-	-	1	2
14	136	9	6	55	41	1	76	24	16	6	1	-	71	22

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT WASHINGTON STREET, MIDDAY, 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	26	17	-	2	1	-	-	-	-	-	2	1	7	7
2	11	1	-	1	-	-	2	2	1	-	-	-	2	5
3	2	-	-	2	1	-	1	1	-	-	-	-	2	-
4	-	-	-	1	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	1	1	-	-	-	-	1	-
7	-	-	-	-	-	-	-	1	-	-	-	-	-	-
8	3	-	-	-	-	-	1	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	1	-	-	-	-	-	-	-	-	-	-	-	2	-
11	2	-	-	-	-	-	-	-	-	-	-	-	3	2
12	8	-	-	-	1	-	-	-	-	-	-	-	-	-
13	13	-	-	-	1	-	1	-	-	1	-	-	2	2
14	60	1	-	11	4	1	9	7	3	-	2	-	8	5

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT WASHINGTON STREET, P.M., 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1	-	-	-	-	-	-	-	-	-	1	-	10	6
2	3	-	-	1	-	-	-	2	-	-	-	1	13	5
3	6	-	-	-	1	-	-	1	1	-	-	-	2	2
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	1	-
6	-	-	-	-	-	-	1	-	-	-	-	-	3	-
7	2	-	-	-	-	-	-	1	-	-	-	-	3	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	2	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	1
11	3	-	-	3	-	-	-	-	-	-	-	-	4	2
12	4	-	-	2	4	-	-	-	-	-	-	-	-	-
13	11	1	-	-	3	-	1	-	-	-	-	-	1	3
14	41	5	1	14	2	-	10	2	2	1	-	-	38	14

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT BOYLSTON STREET, A.M., 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	3	1	-	-	1	-	-	-	-	-	-	-	-	1
2	2	2	-	-	-	1	-	-	-	-	-	-	-	-
3	3	7	1	1	1	-	1	-	-	2	2	-	2	5
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	1	2	-	-	-	-	-	-	-	-	-	-	-	-
8	-	2	-	-	-	-	-	-	-	1	-	-	1	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	1	-	-	-	-
11	1	-	-	-	-	1	-	-	-	-	-	-	1	-
12	6	-	-	1	4	2	1	-	-	-	1	-	-	-
13	27	13	6	4	4	6	1	2	-	11	6	-	3	17
14	84	65	6	36	45	13	46	2	15	63	16	-	22	53

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT BOYLSTON STREET, MIDDAY, 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	-	-	-	-	1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	1	-	-	-	-	2	1	-	2	1
3	2	3	-	-	1	-	-	-	-	1	-	-	1	4
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	1	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	2	-	-	-	-	-	-	-	1	-	-	-	3
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	2	-	1	-	-	-	-	-	-	-	-	-	-
12	7	-	-	-	-	-	-	-	-	-	-	-	-	-
13	24	3	6	-	1	1	1	-	-	5	3	-	1	6
14	41	21	7	7	4	10	9	6	3	12	13	-	13	22

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT BOYLSTON STREET, P.M., 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
2	-	1	1	-	-	-	-	-	-	-	1	-	-	2
3	4	5	1	1	1	-	3	2	-	2	1	2	6	18
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	1	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	2	-	-	-	-	-	-	-	-	-	-	-	1
8	2	1	1	1	1	-	1	-	-	-	1	-	1	8
9	-	-	-	-	-	-	-	-	-	-	-	-	-	3
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	1
12	2	-	-	1	2	-	-	-	-	-	-	-	-	-
13	12	6	-	-	1	2	3	-	-	2	1	-	-	8
14	25	19	6	2	7	-	9	2	4	22	11	-	20	45

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT SCHOOL STREET, A.M., 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	-	-	-	-	2	-	-	-	1	-	-	-	1	2
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	1	1	-	2	-	1	-	-	-	1	-
4	1	-	1	3	3	-	2	1	1	1	1	-	3	4
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	2	-	-	1	-	-	-	-	-	-	1
8	1	-	-	2	5	-	3	-	2	1	-	-	1	4
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	1	-
12	-	-	-	5	3	-	2	-	-	-	-	-	-	-
13	6	-	-	10	7	-	7	-	5	3	-	-	2	5
14	11	-	-	31	18	1	17	2	9	2	-	-	20	9

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT SCHOOL STREET, MIDDAY, 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	-	-	-	1	1	-	4	-	-	1	1	-	12	9
2	-	-	-	-	-	-	1	-	-	-	-	-	2	-
3	1	-	-	3	-	-	1	-	1	-	-	-	5	2
4	-	-	-	-	-	-	1	-	-	-	-	-	6	7
5	-	-	-	-	-	-	-	-	-	-	-	-	1	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	1	-	-	-	-	-	1	-	-	1	-	-	-	2
8	-	1	-	-	2	-	3	-	3	-	-	-	6	13
9	-	-	-	-	-	-	-	-	-	-	-	-	1	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	1	-	-	1
12	2	-	-	1	-	-	-	-	-	-	-	-	-	-
13	4	-	-	2	4	-	4	-	2	1	-	-	2	4
14	7	-	-	13	10	-	5	2	2	3	-	-	13	1

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT SCHOOL STREET, P.M., 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	-	-	-	1	-	-	3	-	1	1	1	-	10	9
2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
3	1	-	-	2	-	-	1	-	1	-	-	-	4	2
4	-	-	-	-	-	-	2	-	-	-	-	-	3	6
5	-	-	-	-	-	-	-	-	-	-	-	-	1	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	1	-	-	-	-	-	1	-	-	1	-	-	-	3
8	-	1	-	-	3	-	2	-	4	1	-	-	7	8
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	1	-	-	1
12	1	-	-	2	-	-	-	-	-	-	-	-	-	-
13	3	-	-	3	2	-	4	-	3	1	-	-	3	4
14	5	-	-	8	4	-	4	2	4	3	-	-	14	2

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT TREMONT STREET, A.M., 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	3	7	3	-	-	-	-	-	-	2	2	-	2	10
2	3	3	1	-	-	-	-	-	-	-	1	-	-	2
3	-	1	-	-	-	-	-	-	-	-	-	-	-	1
4	-	4	-	-	-	1	-	-	-	-	1	-	-	3
5	-	-	-	-	-	-	-	1	-	-	-	-	1	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	1
7	-	4	2	-	2	-	1	-	-	-	2	-	1	7
8	-	3	2	-	-	-	-	-	-	1	2	-	-	6
9	-	-	-	-	-	-	-	-	-	-	-	-	-	2
10	1	-	1	-	1	-	-	-	-	-	1	-	-	-
11	-	1	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	1	-	-	-	-	-	-	-	-	-	-	-
13	4	12	8	2	-	-	1	7	-	2	6	-	4	41
14	9	9	5	6	3	-	1	3	-	-	3	-	6	18

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT TREMONT STREET, MIDDAY, 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	2	19	16	-	3	2	3	7	2	5	2	9	14	53
2	2	-	-	-	-	-	-	-	-	1	-	1	2	7
3	-	1	1	-	-	-	1	-	-	-	-	-	1	3
4	3	4	2	-	1	-	1	1	-	-	2	2	2	25
5	-	1	1	-	-	-	-	-	-	-	3	-	-	4
6	1	-	-	-	-	-	-	-	-	-	-	-	-	1
7	1	9	4	-	-	-	1	-	-	3	4	-	2	19
8	4	7	-	1	-	-	1	1	-	3	5	-	6	34
9	-	-	-	-	-	-	-	2	1	-	-	-	-	1
10	1	8	1	-	-	-	-	-	-	-	-	-	1	5
11	-	1	-	-	-	-	-	-	-	-	-	1	-	3
12	1	-	-	-	-	-	-	-	-	-	-	-	-	-
13	25	14	15	-	1	-	1	9	-	2	5	-	7	45
14	40	16	13	2	1	1	4	9	-	3	5	-	4	33

Appendix Table 1 (Continued)
ORIGIN AND DESTINATION OF DRIVERS, CBD TRAFFIC INTERVIEWS AT TREMONT STREET, P.M., 1963

Zone of Origin	Zone of Destination													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	6	7	4	-	-	-	2	6	-	-	7	11	19	80
2	-	1	-	-	-	-	-	-	-	-	-	1	5	17
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	1	1	1	-	-	-	-	1	-	-	2	5	4	33
5	-	-	1	-	-	-	-	-	-	-	-	1	2	15
6	-	-	-	-	-	-	-	-	-	-	-	-	2	1
7	1	5	1	-	-	1	1	-	-	1	1	-	3	50
8	-	3	1	-	1	-	1	-	-	1	2	-	4	34
9	-	1	2	-	-	-	-	-	-	-	-	-	-	9
10	-	-	2	-	-	1	-	1	-	-	-	-	2	4
11	-	-	-	-	-	-	-	-	-	-	-	-	1	3
12	-	1	-	-	-	-	-	-	-	-	-	-	-	-
13	8	21	7	-	-	-	-	2	-	2	6	-	3	45
14	5	2	5	-	1	-	3	2	-	-	-	-	3	23

Appendix Table 2
SOURCES OF MATERIAL

Boston Redevelopment Authority
Boston Traffic and Parking Department
Massachusetts Department of Public Works
Metropolitan District Commission
Boston Police Department
Eastern Massachusetts Regional Planning Project
Massachusetts Bay Transportation Authority
Wilbur Smith and Associates
Boston College

Appendix Table 3
EXISTING MOTOR VEHICLES PERSON-TRIPS TO DOWNTOWN BOSTON

Auto Person-Trips	154,800
Truck Driver Trips	15,300
Truck, Taxi, and School Bus Passenger Trips	5,400
Taxi Driver Trips	12,100
External Auto Person-Trips	22,000
External Truck Driver Trips	1,100
	210,700

Source: Eastern Massachusetts Regional Planning Project Origin and Destination Data.

Appendix Table 4
VEHICLES ENTERING DOWNTOWN BOSTON, 1980

Existing Motor Vehicle Volumes to Boston (1963)[1]		140,000
Existing Through Person-Trips by Auto:[2]	366,250	
Average Occupancy:	1.54	
Existing Through Volume (Auto)		238,000
Existing Through Volume (Trucks)[3]		42,000
Expected Additional Volumes[4]		95,000
Total 1980 Volumes:		515,000

[1] From Table 16 of text and Appendix Table 3.

[2] 1963 Eastern Massachusetts Regional Planning Project Origin-Destination Study.

[3] Assumes trucks account for 15 percent of Total Through Volumes.

[4] Based on estimated capacity and usage of new or improved highway facilities.

Note: Derivation of Summary of Future Travel Projections (By Vehicles and Occupants) to Downtown Boston was accomplished as follows:

Assuming 63.5 percent (from 1963 O-D Study) of all vehicle trips to Boston Proper are Through Trips:

63.5 percent of 515,000 or 327,000 vehicles will be Through Vehicles.

(515,000-327,000) or 188,000 vehicles will be destined to Downtown.

Assuming these 188,000 vehicles destined to Downtown Boston are distributed as in 1963, as shown in Table 16, there will be:

$\frac{123,500}{140,000}$ (188,000) or 165,800 automobiles, and

$\frac{16,500}{140,000}$ (188,000) or 22,200 trucks destined to Downtown Boston.

Assuming occupancy rates remain as in 1963, there will be:

165,800 (1.54) or 255,400 person-trips by auto, and

22,200 (1.2) or 26,600 person-trips by truck.

Appendix Table 5
TRAVEL GENERATING FACTORS

Land-use	Trip Generation (in square feet of use per person-trip)
Retail, Consumer Services and Institutional	70-100
Manufacturing and Utilities	110-140
Office	175-200
Wholesale and Storage	250-350

ZONE MAP
For traffic interview stations

NOTE:
ZONE NUMBERS ARE A REFERENCE FOR APPENDIX TABLE I.

APPENDIX FIGURE 1

NOON HOUR PEDESTRIAN MOVEMENTS

NOTE:

ARROW SIZE REPRESENTS RELATIVE NUMBER OF INTRAZONAL AND INTERZONAL WALKING TRIPS.

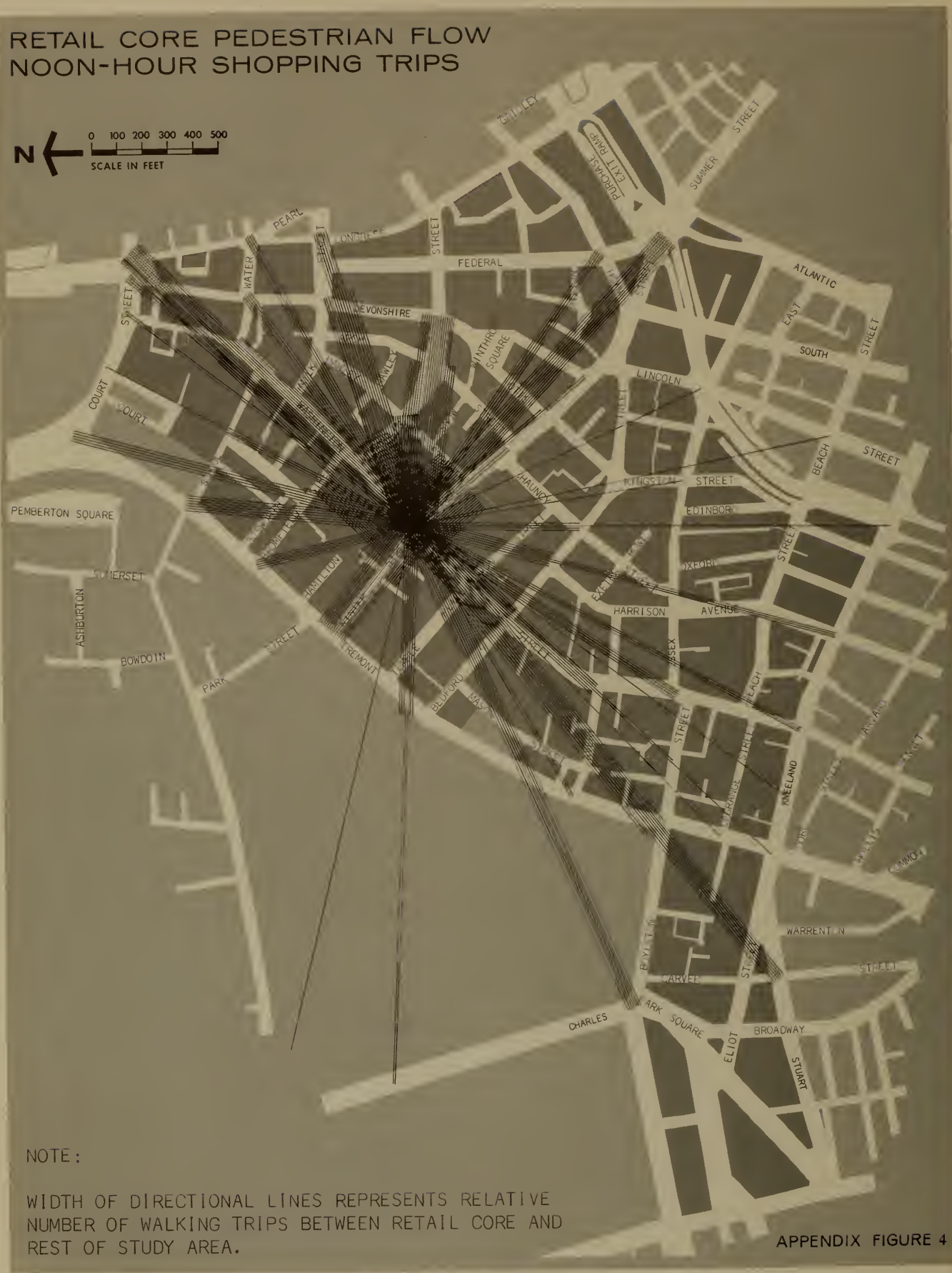
APPENDIX FIGURE 2

EVENING PEAK-HOUR PEDESTRIAN MOVEMENTS

NOTE:

ARROW SIZE REPRESENTS RELATIVE NUMBER OF INTRAZONAL AND INTERZONAL WALKING TRIPS.

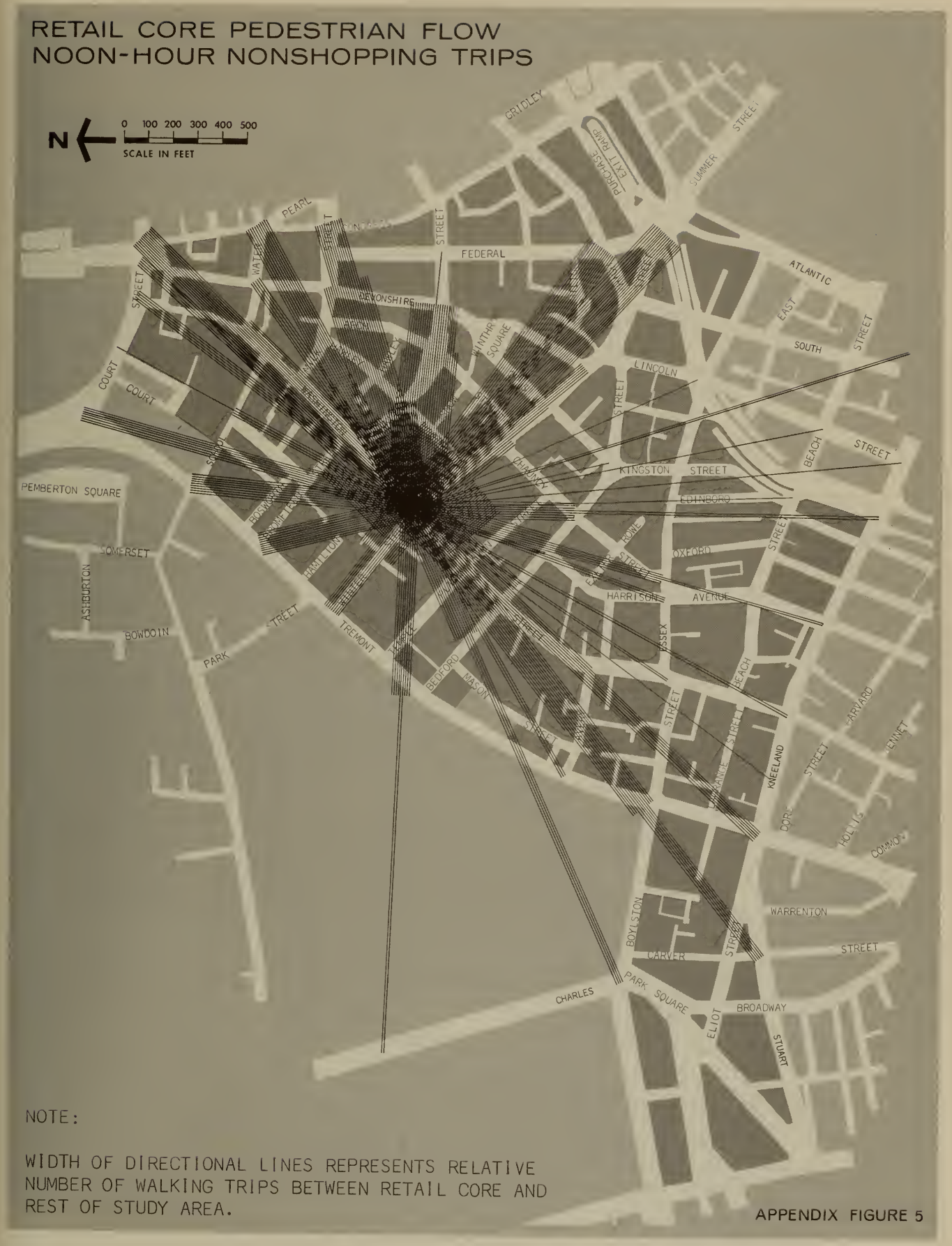
APPENDIX FIGURE 3



NOTE:

WIDTH OF DIRECTIONAL LINES REPRESENTS RELATIVE NUMBER OF WALKING TRIPS BETWEEN RETAIL CORE AND REST OF STUDY AREA.

APPENDIX FIGURE 4



APPENDIX FIGURE 5

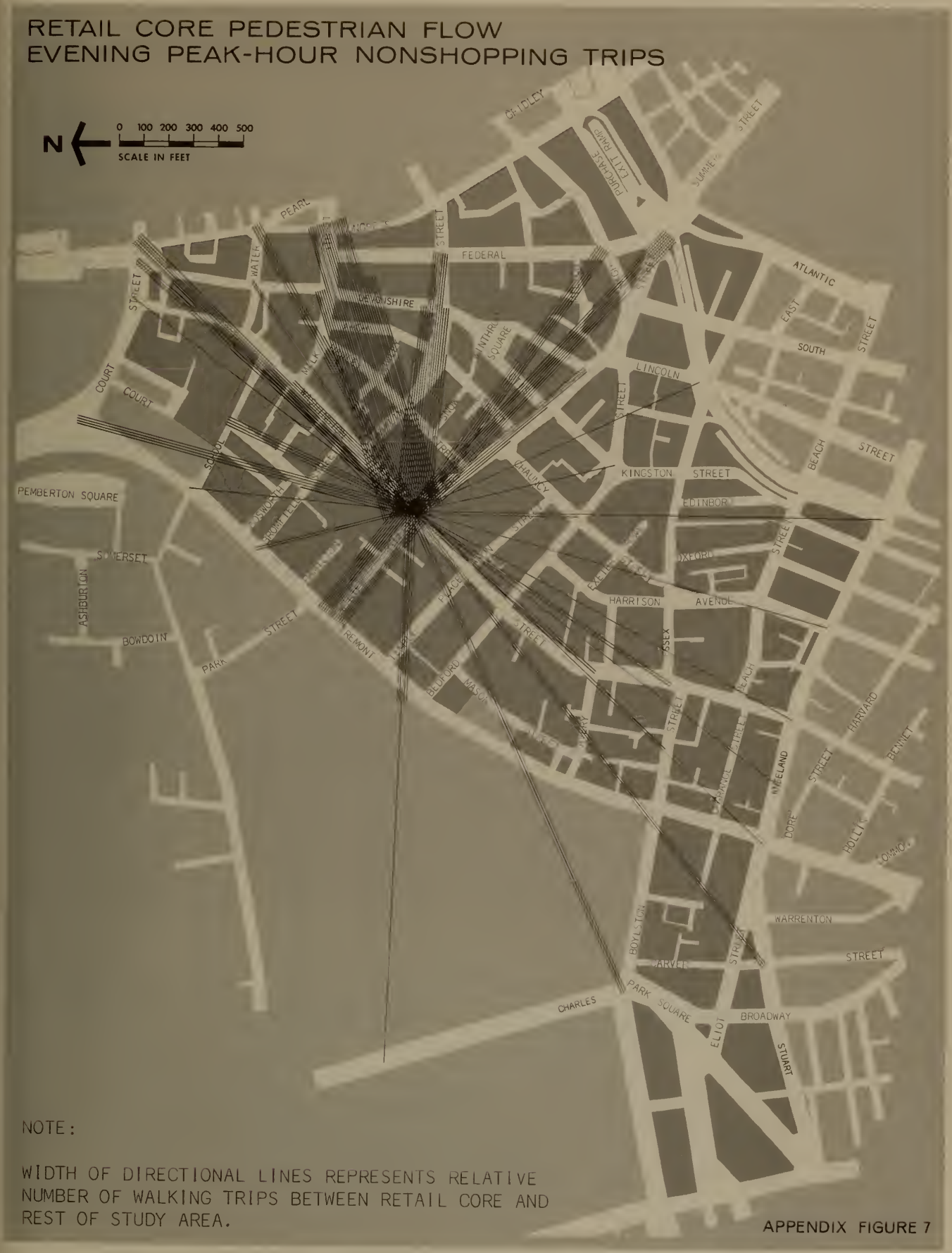
RETAIL CORE PEDESTRIAN FLOW
EVENING PEAK-HOUR SHOPPING TRIPS

NOTE:

WIDTH OF DIRECTIONAL LINES REPRESENTS RELATIVE NUMBER OF WALKING TRIPS BETWEEN RETAIL CORE AND REST OF STUDY AREA.

APPENDIX FIGURE 6

RETAIL CORE PEDESTRIAN FLOW
EVENING PEAK-HOUR NONSHOPPING TRIPS



NOTE:

WIDTH OF DIRECTIONAL LINES REPRESENTS RELATIVE NUMBER OF WALKING TRIPS BETWEEN RETAIL CORE AND REST OF STUDY AREA.

APPENDIX FIGURE 7

PARTICIPATING PROFESSIONAL STAFF OF BARTON-ASCHMAN ASSOCIATES

Michael A. Powills, Jr., *Project Administrator*
Richard C. Gern, *Project Engineer*
Fred M. Schweiger, *Project Engineer*
Dave Dillard, *Project Engineer*
William S. Leahy, Jr., *Project Engineer*
Joseph J. Kim, *Field Survey Supervisor*